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ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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ANNALS OF SURGERY

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JULY, 1912

No. 1

ORIGINAL MEMOIRS.

NEPHRECTOMY.*

A STUDY BASED ON THE RECORDS OF 112 CASES.

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IF we consider the enormous quantity of successful work done on the human kidney at our time, it is noteworthy to remember, that the birth of modern renal surgery dates back only to 1869, that is a little more than 42 years, when, to cure an abdomino-ureteral fistula, Gustav Simon of Heidelberg deliberately and successfully removed a healthy kidney. The momentous step was undertaken only after the question, namely, whether the human organism could survive the loss of this organ, had been carefully investigated both in the light of clinical experience, but mainly by animal experiment.

The material for this paper (with one exception,—a case of renal echinococcus †) has been collected from the records of the First Surgical Division of Mt. Sinai Hospital, which I have the honor to direct. It comprises a term of 16 years, beginning in 1895 and ending with December, 1911. The documentary proofs are accessible in the following places:

1. In a "Contribution to the Surgery of the Kidney and

* The President's Address, American Surgical Association, May 29, 1912.

† From my former service at the German Hospital, New York City.

Ureter," *American Journal of Medical Sciences*, June, 1897, p. 677.

2. In the *Mt. Sinai Hospital Reports*, volumes i, ii, iii, iv, and v.

3. In the bound volumes of the original Mt. Sinai Hospital Records (of case histories) of the First Surgical Division (unpublished).

Roughly, the material may be divided into the following groups:

| | Cases. | Deaths. | Percentage of mortality. |
|----------------------------------|--------|---------|--------------------------|
| Pyonephrosis | 61 | 9 | 14.75 |
| Tuberculosis | 20 | 4 | 20.00 |
| Hydronephrosis | 11 | 3 | 33.33 |
| Neoplasms | 18 | 8 | 44.40 |
| Echinococcus | 2 | 0 | |
| Polycystic disease | 1 | 0 | |
| <hr/> | | | |
| Total | 112 | 24 | |
| Total mortality, 21.33 per cent. | | | |

Note.—The great majority of operations herein reported were done by the author. A smaller number were performed under his authority by the associates and adjuncts who were and still are attached to the service: Drs. Lilienthal, Van Arsdale, Berg, Moschcowitz, Beer, and Lewisohn.

GENERAL CONSIDERATIONS.

Diagnostics.—Those who were in active practice before the advent of cystoscopy will remember the diagnostic uncertainties and anxieties of the surgeon, when, having determined upon the removal of one kidney, he had to face the question of the functional capacity of the other kidney. The clumsy and unreliable expedient of laparotomy for ascertaining by touch the presence, size, and nature of the mate of the diseased organ, had to be resorted to, and many times risks had to be taken, which nobody would consider justifiable to-day. To-day, as a matter of routine, the physical examination is completed in the generally accepted manner by catheterization of both ureters. Radiography is regularly employed, not only to ascertain the presence of calculi but also to throw

light upon the relations of a lumbar tumor to the stomach and the large intestine. The general condition of the patient is carefully gone into, and, in the presence of complicating troubles, the chances of the operation are well weighed. When the hæmoglobin test indicates less than 30 per cent., no operation is undertaken if the anæmia is due to neoplasm or to a chronic form of suppuration; if on the other hand it is the consequence of recent copious hemorrhage, nephrectomy as a hæmostatic life saving measure is unhesitatingly done. Case IV, page 9, shows that in the presence of a hæmoglobin percentage of 21, nephrectomy saved the patient's life.

Preparation of the Patient.—The preparative measures employed were those usual before major abdominal operations. The skin of the lumbar and hypochondriac regions was shaved, scrubbed with soap-suds and a gauze mop, then washed with ether and a watery sublimate solution of 1 to 500. The posture was lateral, bringing the field of operation uppermost, the patient's knees being bent at a right angle; this to counteract the tendency to the prone posture. Formerly a large and hard, cylindrical horse-hair cushion was inserted under the waist of the patient for the purpose of producing a certain degree of lateral curvature of the spine, which determined a protrusion of the loin. Nowadays this aid is secured by a special attachment to the operating table, worked by crank and ratchet. To facilitate easy approximation of the edges of the wound for suture, this elevation of the loin is dispensed with at the end of the operation.

The Grossich method of disinfecting the skin with tincture of iodine was only used in emergency cases.

Exposure of the Kidney and Vessels.—Among the many modifications of the original Simon incision, none has proven as useful as the oblique one, beginning where the outer edge of the sacrolumbalis muscle overlaps the twelfth rib, and running downward and forward diagonally across the lumbar space toward the crest of the ilium, the inclination and length of the incision depending upon the situs and size of the organ. The obliquity of this line runs parallel with the

twelfth intercostal nerve and artery, injury to which is thus easily avoided. The muscles are divided down to the transversalis fascia. When this is divided, the fatty capsule of the kidney comes in view. When dealing with a suppurating or tuberculous kidney, or with a new growth, it is very advisable not to proceed any further before having ascertained the exact place of the peritoneal reflection, and this for several good reasons. In handling a kidney distended by pus, it is a very frequent occurrence that abscesses are ruptured, their escaping contents soiling the wound. In the presence of close adhesions, such a rupture may happen simultaneously with tearing of the peritoneum, and peritoneal infection may follow, *especially when the surgeon is not aware that the peritoneum was actually rent*. Such an undetected injury to the peritoneum constitutes, in fact, one of the most serious accidents that may happen in the course of nephrectomy. With the peritoneum well recognized and in full view, its injury is immediately noticed and remedied by suture or packing.

The exposure of the peritoneum has another great advantage. It may be incised, and the relations of a large tumor may thus be exactly gauged by palpation and inspection. But the greatest advantage consists in this, that exposure of the retroperitoneal space opens up the direct route to the renal vessels. Early in the sixties of the last century, Langenbeck laid down the sound principle, that in the excision of large tumors holding close relations to important vessels, before attempting the dissection of the tumor, the surgeon's first duty should be to reach and lay bare its principal blood supply, so as to protect himself against accidental hemorrhage. The absolute value of this simple principle was proven to me so many times under otherwise formidable circumstances, that I do not hesitate to recommend its use in the strongest terms, especially where a large solid tumor of the kidney is to be removed.

There is another point I wish to mention. Sometimes the peritoneum, which is adjacent to the anterior aspect of the

kidney, is so closely adherent to the tumor, that it is impossible to separate it without tearing the kidney and contaminating the wound and peritoneal cavity with escaping matter. In such a case it is imperative to excise the adherent peritoneum *en bloc* with the mass. This early exposure of the relations of the diseased organ with the peritoneum will at once clear up the situation, will enable the surgeon to circumcise the adherent peritoneum, and to close the peritoneal cavity either before or after the deligation of the renal vessels, thus guarding both against accidental hemorrhage and against accidental pyogenic or neoplastic infection. To the observance of this rule may be attributed the fact, that in not one of the cases herein reported, was post-operative peritonitis observed.

The relations of the kidneys to the hepatic and splenic flexures of the colon have not only a great diagnostic value, but must receive attention during the progress of nephrectomy for neoplasm. I have found that the hepatic flexure has rarely caused trouble, as it is generally found to be displaced downward, well out of the operative field. The left kidney, however, with its normal situs somewhat higher than that of its mate and with the splenic flexure fixed to the diaphragm, is found as a rule holding intimate relations with the last part of the transverse colon, which may adhere very closely to the anterior surface of the kidney. An illustration of this circumstance may be found in the history of Case XXXVIII, page 39.

Here, as well as in all cases where the entire kidney or its upper pole lies hidden behind the lower ribs, additional incisions may be required to permit of a safe procedure. To this we shall shortly return. For the present let us say then, that the primary exposure and identification of the peritoneal reflection is advisable in all cases; it is necessary whenever we are dealing with a suppurating kidney, and is of the utmost use, where the great size of a renal new growth demands circumspection in gauging adhesions to adjacent tissues and organs, and the preliminary securing of the renal vessels indispensable. It is evident that the oblique incision will readily admit safe handling of adhesions of the fibrous to the fatty

capsule about the lower pole of the kidney. It is otherwise with those situated at the upper pole. Extreme variations are observed in the height of the situs of the kidneys in reference to the lower segment of the thoracic skeleton. Sometimes, even in deep anæsthesia, it is impossible to palpate a kidney of normal size, and indeed, a kidney tumor of considerable size may not be palpable on account of its high situs. In one of our cases auscultation demonstrated that the diaphragm was displaced upward, percussion showing that a large area of dullness existed below it. This, together with the findings of cystoscopy, justified the conclusion that the kidney, though not palpable, was much enlarged.

To expose the upper pole in such cases, a vertical subsidiary incision was added to the oblique one, running according to necessity in about the scapular line upward across one, two, or even three ribs. This vertical incision divided the muscles down to the ribs, permitting free lateral retraction, by which two or three inches of the rib were exposed. Subperiosteal resection of the rib or ribs having liberated the costal border, the pleural sinus became thus mobilized and was readily drawn upward out of the way. A moderate amount of care sufficed in most cases to prevent injury of the pleura. Should this occur however, the accident is not of great importance, and its significance has been greatly exaggerated. Pressure with a pledget of moist gauze will stop leakage of air for the time being, and a suture will secure the rent at the end of the operation. We have never seen serious consequences following limited pleural injury, and in one case of calcifying echinococcus of the kidney, where a considerable area of the adherent pleura had to be taken away with the rigid sac,¹ the momentary collapse of the lung was overcome by plugging and artificial respiration.

Accidental and Secondary Hemorrhage.—Accidental arterial hemorrhage during the progress of nephrectomy occurred once.

¹ Contribution to the Surgery of the Kidney and Ureter, American Journal of Medical Sciences, June, 1897, p. 677.

CASE I.—*Hemorrhagic infarct of left kidney following catheterism. Nephrotomy; no improvement. Nephrectomy; slipping of ligature from pedicle, arterial hemorrhage, clamping, religature, cure. Specimen: total parenchymatous necrosis of kidney.* (Contribution, *loc. cit.*, p. 691.)

Mrs. S. S., age thirty-four, suffered since years from urinary troubles, requiring occasional catheterism. December 7, directly after use of catheter, was suddenly seized with acute, cutting pain in left loin, followed by severe rigor, high fever, radiation of pain to left thigh, and much vomiting. On admission, December 13, 1896, temperature 104° F., continuous desire to urinate, though the bladder was empty, small rapid pulse, vomiting; in the left loin a large very tender tumor. Urine scanty, 1022, containing a few white and red blood-corpuscles and a trace of albumin. Immediate nephrotomy; circumrenal fat turgid, œdematous, kidney very much enlarged, capsule tense; after its incision the dusky and very brittle parenchyma protruded in the manner of a hernia. Freely incised, *it did not bleed*, but yielded only quantities of turbid dark red serum. In digitally dilating the aperture made into the pelvis, some tissue gave away to slight tension, when profuse arterial hemorrhage followed. This was controlled by small tampon. The kidney was stripped out of its capsule, was surrounded by a moist pack of gauze, and the pelvis was drained by a tube. There followed immediate cessation of the exquisite local pain, but the fever and vomiting persisted. Copious serosanguinolent oozing that generally follows nephrotomy was absent, dressings remaining strangely dry. Strangury also persisted. December 20, first packings being removed, renewed arterial bleeding followed by the escape of thick pus from the renal pelvis. Renewed packing stopped the hemorrhage. By January 7 daily quantity of urine had risen from 16–18 oz. to 60 oz., and as under a hectic fever the patient was losing ground, nephrectomy was done. It was observed then, that the enormous swelling of the kidney found at nephrotomy had disappeared, and that the size of the organ had shrunk to the subnormal. Moreover it was flabby and unusually brittle. An abscess broke near the pedicle, which was very short and inaccessible. When the kidney had been cut away, the mass ligature either cut through or slipped off, and this was followed by a frightful gush of arterial blood. However, digital

compression luckily controlled the flow until all the blood was mopped away, so that a large clamp could be applied under the guidance of the eye. Then the stump was religatured and the entire wound packed and left open. Ligature came off January 29. Discharged cured February 25. All the parenchyma of the kidney was necrotic and in a state of disintegration.

Accidental venous hemorrhage was observed twice.

CASE II.—*Tuberculosis of right kidney. Nephrectomy. Tearing of renal vein. Hemorrhage. Death.* (*Hospital Records*, 906-7, vii, p. 837.)

Lizzie D., age forty-two, Russian. Admitted, June 18, 1907. Six months ago began to have frequent and painful micturition, two months ago bloody and purulent urine. Had lost 30 pounds in weight. No lumbar pain. Marked emaciation and anæmia, lungs free; on admission, in right loin more resistance to deep palpation than in left, no tumor felt. June 19: Cystoscopy. Both ureteral orifices normal. Right side of trigonum studded with ecchymotic patches. Catheters passed easily. Urine from right kidney loaded with tubercle bacilli. June 21: Nephrectomy. Typical procedure. Ureter divided, artery tied securely. In tying the stretched renal vein, the vessel gave way in the line of the ligature. Immediate compression controlled the hemorrhage, so that not much blood was lost. Vein was clamped near its entrance into vena cava. Wound packed. The patient had become deeply shocked. An intravenous infusion slightly improved the pulse, but this was of short duration and the patient expired 30 minutes after the conclusion of operation.

CASE III.—*Calculous pyonephrosis of right side. Primary nephrectomy. Hemorrhage due to tearing of pedicle. Suture-ligature. Cure.* (*Hospital Records*, 1905-6, vii, p. 639.)

Lena G. R., age thirty-four, housewife. Admitted May 22, 1906. About ten years ago attacks of severe right lumbar pain, radiating to bladder, which came and went for about two years. Since then a dull ache persisted; there was bloody urine at times. Urination painful but not frequent. On admission: General condition good. Temperature slightly febrile, pulse 72-110, urine amber, turbid, 1020, loaded with pus and some red blood-cells. Abdomen, lax, easily palpable. Kidneys cannot be palpated, pres-

sure in right loin not painful. May 23: Cystoscopy. Right side of trigonum and bladder wall coated with adherent pus; mucosa injected with hemorrhagic patches. Both ureteral catheters easily passed; from right side semisolid purulent material escaping, from left side clear amber urine. Urine: right side yields only thick pus; left side, clear, pale amber, 1020, urea 1.7 per cent., a few pus- and red blood-cells. May 24: Primary nephrectomy. The high situation demanded resection of twelfth rib. Easy separation of numerous adhesions, elastic ligature of pedicle. In dividing tense pedicle, a portion of its proximal side was torn, profuse hemorrhage following. But the stump was caught in a clamp and was secured by a double ligature passed through its base by means of a needle. The kidney was a pus sac devoid of parenchyma. Uninterrupted recovery. Discharged cured June 18, 1906.

Epicrisis.—When securing a pedicle containing large vessels, it is best to tie and divide the vein first, and then the artery. The opposite procedure is apt to put too much tension on the delicate walls of the vein, which, unduly stretched, may easily be cut or rent by the ligature.

Secondary post-operative arterial hemorrhage following seven days after nephrotomy was observed once, necessitating nephrectomy.

CASE IV.—*Non-septic hemorrhagic infarcts of right kidney. Nephrostomy drainage. Secondary renal hemorrhage seven days after operation. Revision and resuturing of kidney. Renewed hemorrhage. Extreme anæmia. Nephrectomy. Syncope. Recovery.* (Hospital Records, 1905-6, vii, p. 713.)

Paul B., age twenty-eight, Russian, storekeeper. Admitted June 15, 1906. Fourteen months ago hæmaturia with vomiting and severe pain in right loin radiating to penis, but no chill or fever. Since then no hæmaturia, but a constant dull pain, frequently accentuated to paroxysms with vomiting. During the attack very frequent and painful voiding. On admission, poorly nourished. Temperature 99° F., pulse 80. Neither kidney palpable, no lumbar pressure pain. Urine: Bloody, 1008, acid. June 17, cystoscopy: Left side, 1032 and trace of albumin, a few red blood-cells. Right side, 1024 and loaded with blood. Both

catheters had been easily passed into pelves. Radiograph negative. June 21: Exploratory nephrotomy. Extensive adhesions of fatty capsule to fibrous coat. Kidney developed. Palpation negative. Long incision (with knife) along convexity down into pelvis. No gravel or stone found. A segment of parenchyma being excised, the pelvis was drained with a small tube and the kidney was sutured by a number of deep and superficial sutures. Little reaction followed. June 28, profuse hemorrhage both through drainage tube and into bladder, from which massive clots were washed out with much difficulty. June 30: Hæmoglobin down to 27 per cent., still bleeding. July 1: Revision of kidney wound. Reopening of wound and redelivery of kidney. No hemorrhage followed. Therefore the kidney sutures were left intact, but five more deep sutures were passed through the parenchyma. The kidney was replaced and the wound packed to the bottom with considerable pressure. July 2: Hæmoglobin 21 per cent., and the hemorrhage still continuing. Nitrous oxide anæsthesia. Rapid nephrectomy; elastic mass ligature. Deep syncope with stoppage of breathing overcome by artificial respiration and intravenous stimulation. Specimen: a number of old white infarcts, the contents of some of which (the largest one two inches in diameter) were disintegrated and replaced by clotted blood. Slow recovery. Discharged cured August 25, 1906.

Management of Fatty and Fibrous Capsules.—Heretofore, little attention was paid by authors to the management of the fatty capsule, except as one of the barriers to be overcome during the exposure of the kidney. The condition of the fat itself may have a diagnostic value. In sudden and stormy infectious processes, such as are the acute septic hemorrhagic infarct, acute septic parenchymatous nephritis, acute gonorrhœic nephritis, in short, whenever a marked acute swelling of the parenchyma produces great tension of the fibrous capsule, we find invariably the renal fat in a state of pronounced acute œdema. In chronic processes on the other hand, such especially as calculous disease or tuberculosis of old standing, we find the fat has disappeared,—sometimes entirely, nothing remaining but a sparse network of thin connective tissue, here and there, or in its entirety condensed into

extremely tough and resistant adhesions between the fibrous capsule, the peritoneum, the diaphragm, and the transversalis fascia. These adhesions then offer almost insurmountable difficulties to the safe removal of especially such kidneys as have undergone partial or total suppurative liquefaction. In tuberculosis, but especially in cases of malignant neoplasms, the fatty capsule,—in conformity with the general rule,—ought to be removed *en bloc* with the diseased kidney. Where the tumor is of moderate size, this can be accomplished with little difficulty through a generous incision, and the step will carry a valuable guaranty against relapse, especially where the new growth is still confined within the limits of the fibrous capsule.

In tuberculosis, whether or not perforation has occurred, to gain security against recurrence, it would be rational to remove the infected fatty and fibrous structures. Where the disease is of recent standing and still intracapsular, the task is feasible; but where the process has advanced to the formation of abscesses in the cortex, such an attempt may cause much mischief. It may lead to rupture and to contamination of the wound, of the peritoneum, or pleura even before the vanity of the undertaking had become manifest. Such unsuccessful efforts, after much loss of time and the infliction of futile traumatism, leave the wound in a sorry mess, and engender bad results.

The adhesions binding down the kidney in cases of pyonephrosis of old standing are just as firm, short, and unyielding as in tubercular mischief. As this class of cases comprises more than one-half of the maladies demanding nephrectomy, it is fortunate that we have a ready expedient, which enables us to evade the dangerous necessity of battling with close adhesions. This expedient is known as the *subcapsular procedure*. Whenever it becomes evident that division of the adhesions at the upper and lower poles of the kidney would involve tedious and risky dissection, rupture of a pus sac, and simultaneous injury to the soiling of adjoining large cavities, the subcapsular method should be adopted. The

exposed surface being well protected by packings, abscesses located near the surface of the kidney should be first emptied either by trocar or by incision. Then the fibrous capsule having been split along the entire length of the convexity, is rapidly stripped off to the pelvis, upon which it becomes reflected back, so that a more or less massive pedicle is formed containing vessels, the pelvis, and sometimes the ureter. Around this is thrown an elastic ligature of solid rubber, and the kidney is cut away on the distal side. Sometimes it will be found unavoidable to lay this incision through the parenchyma itself, so that parts of the kidney tissue will still compose a portion of the terminal parts of the stump. But as this must slough away, no fear need be entertained that secreting tissue will be left behind to cause a permanent urinary fistula, unless secreting tissue has remained standing on the proximal side of the ligature. In a difficult case not included in the present series (it had occurred before 1895) where the pedicle was extremely short, this very accident was encountered. Kidney tissue had been left behind on the proximal side of the elastic ligature. The patient did well, but a urinary fistula remained, which was cured by the secondary excision of a small remnant of parenchyma.

For obvious reasons the subcapsular method should not be employed in tuberculosis; occasionally, however, this will be unavoidable. Among our cases there was one in which the expedient was of notable service; but the course of healing was not devoid of the consequences of leaving behind diseased tissue.

CASE V.—*Tuberculosis of dystopic right kidney. Subcapsular nephrectomy. Cure.* (*Hospital Records*, 1909-10, x, p. 1456.)

Rose E., age twenty, shop-girl, Russian. Admitted October 23, 1909. Two and a half years ago began to suffer from sharp attacks of pain in right iliac region, accompanied by chills and fever. No urinary symptoms. In March, 1908, was operated upon at another hospital for appendicitis; was told afterward that she had a displaced kidney which was "hitched up" (?). Continuance of attacks of chills and fever. After this operation

urination became frequent and painful, the urine always turbid, sometimes bloody. Five weeks ago an attempt had been made in same hospital to remove the kidney, but was abandoned on account of great hemorrhage. Had become emaciated from nightly fever and profuse sweats. On admission: Poor general condition, temperature 103° , pulse 116. Lungs and heart negative. In right iliac fossa a large, tender, and fixed tumor of kidney shape; right loin empty. Urine: amber, turbid, alkaline, 1012, no tubercle bacilli, but amorphous phosphates and pus cells. Cystoscopy. Bladder contracted, capacity 90 c.c. Mucosa normal. Right ureteral ostium oedematous and deeply congested. Catheter passed readily into pelvis of left kidney and discharged abundant, clear urine. Introduction of catheter into right ureter needed considerable manipulation; was arrested at 13 inches; it discharged thick pus of fecal odor, no urine. October 26, sub-capsular nephrectomy: Long incision along crest of ileum to Poupart's ligament; peeling up of peritoneum until tumor was reached. Incision of peritoneum for exploration and ascertainment of the fact that the tumor was the kidney. Difficult separation of about half of the circumference of the tumor from the rim of the small pelvis, where it was densely attached. Splitting and stripping of fibrous capsule, which act opened and discharged several abscesses. Elastic ligature to short pedicle. Dystopia was ascertained to be congenital, due to low origin of renal vessels. Suture of peritoneal incision; drainage and closure of external wound. Pathological report, renal tuberculosis. Slow healing of wound. Ligature came away on twenty-fourth day. Repeated revisions of the wound became necessary on account of the slow and irregular healing, due to tubercular infection of the granulations. January 16, 1910, patient had grown fat and rosy, was discharged cured.

Note.—The scar broke down twice in the course of the year, but ultimately healed firmly. Patient was seen November 2, 1911, in excellent condition.

Management of Pedicle and Ureter.—To complete our remarks on mass ligature by a solid rubber cord, a few facts are to be added. The thickness of the cord should be one-sixth of an inch; this will be strong enough for the heaviest pedicle. It should be pure gum of the best quality, and ought to be

carefully tested before use. In an emergency pure gum rubber tubing (of black color) may be used. The mode of application is as follows: A piece of about 12 inches in length is passed around the pedicle as high up as possible in such a manner, that the middle of the cord will be in contact with the pedicle. Thus each half of the cord will be held by one hand of the surgeon. While an assistant supports the kidney, the surgeon should steadily and firmly stretch the two segments of the cord, and maintaining the tension should cross the two "legs" of the band, the crossing point being in close proximity to the pedicle. At this point another assistant will pass a short piece of stout silk ligature under the point of crossing of the two halves of the rubber cord. Now the surgeon, still maintaining tension, will increase the angle at which the two ends of the cord were held to about 120 degrees, whereupon the silk ligature is firmly tied and the tension of the cord released. The result will be, that the parts of the cord thus released will shorten, thicken, and will crowd up against the silk ligature, while the segment confined within the silk ligature and embracing the pedicle will remain at utmost tension. It cannot slip, it will remain tense to the end, while slowly cutting through the pedicle, and is the simplest and most dependable form of ligature known. It is far preferable to silk or catgut, both of which soon become loose if applied to a stout and œdematous pedicle. The simple method of securing the rubber band with a silk ligature was tested by me hundreds of times without accident, and is much better than a knot tied in the rubber cord itself. It is especially useful where a pedicle of extreme shortness cannot be exposed to sight, and where the trick must be done in the depth of a narrow cleft. The ends both of the rubber cord and the silk ligature are brought out through the angle of the wound left open for drainage. The ureter, if included in the band, will take care of itself. The length of time required for the coming away of the rubber ligature varied between 12 and 36 days, the length of period depending upon the thickness and solidity of the structures composing the pedicle. The

rubber cord was never employed where the pedicle was easily exposed, when the vessels were isolated and tied separately with catgut. In these cases the ureter was also separately ligatured and cut off. Where, in cases of tuberculosis, the ureter was found to be manifestly diseased, it was dissected down close to the bladder, tied off, and removed.

Drainage and Closure of Wound.—The extent of the measures to be taken for drainage will have to depend not only upon the extent of the wound cavity and the amount of traumatism inflicted, but mainly upon the question, whether or not during the progress of the operation any purulent soiling of the wound had occurred. Where the procedure was simple and uncomplicated, it sufficed to place one or two cigarette drains into the recesses of the wound, bringing them out by the posterior angle. Where contamination by rupture of abscess led to soiling, measures were more comprehensive, each angle receiving a drainage tube. Sometimes we lined the whole cavity with a square of gauze, which was then filled according to Mikulicz's plan with a number of separate compresses. At any rate, it is safer to drain more than less where pus has escaped, especially in cases of tuberculosis. Even after the exercise of utmost circumspection, we have had to incise and empty secondary abscess developing along the course of the ureter. Where the healing was sweet, the drains were gradually shortened and withdrawn. It may be said in general, that leaving in a drain one or two days longer than necessary never did any harm, while withdrawing it too soon was invariably followed by trouble.

Where the patient's condition remained good to the end of the operation, the fascial and muscular structures were reunited by two rows of buried chromicized catgut sutures well up to the posterior angle and to the drainage. The skin was brought together with a row of fine silk sutures. Where it became necessary, the more summary method of applying through-and-through silk sutures was resorted to and gave equally good results. Though stitch-hole suppuration was occasionally observed, a breakdown of the entire suture line has happened very rarely.

After-treatment.—The after-treatment was governed by the principles observed after laparotomy, special attention being paid to the amount and quality of the urinary secretion. Proctoclysis while post-operative vomiting persisted, afterward copious draughts of liquids were administered to stimulate the action of the remaining kidney. Invariably enough morphin was given to allay pain, and in no case could ill effects of any kind be conscientiously attributed to its adequate and humane administration. In the absence of complications the patients were gotten out of bed as soon as firm union of the wound was assured, that is on an average on about the tenth day, and this without reference to whether a mass ligature had come away or not. In only one case did the patient return with a lumbar hernia, which had been caused, not by suppuration, but undoubtedly by accidental injury to the nerve supply of the muscular parietes.

PYONEPHROSIS.

Statistics.—Nephrectomy was done for pyonephrosis from all causes in 61 cases. In these the right kidney was concerned in 42, the left one 19 times, operations on the right kidney more than doubling those on the left.

| | Cases. | Deaths. | Percent- age of Mortality. |
|---|--------|---------|----------------------------------|
| Calculous pyonephrosis, primary nephrectomy..... | 17 | 2 | 11.8 |
| Calculous pyonephrosis, secondary nephrectomy..... | 14 | 4 | 28.5 |
| Combined mortality | | | 19.3 |
| Non-calculous pyonephrosis, primary nephrectomy... | 13 | 1 | 7.7 |
| Non-calculous pyonephrosis, secondary nephrectomy. | 17 | 2 | 11.7 |
| Combined mortality | | | 9.7 |
| Primary nephrectomies for all causes..... | 30 | 3 | 10.0 |
| Secondary nephrectomies for all causes..... | 31 | 6 | 19.35 |
| Total for all nephrectomies for pyonephrosis from all causes | 61 | 9 | 14.75 |

Among these there were two cases of dystopic kidney, one calculous (died), and one of hemorrhagic infarct (recovered). Altogether, there were done 9 nephrectomies for hemorrhagic infarct (8 septic, 1 non-septic), which all ended in recovery except one, a septic case.

Note.—As all the cases of infarct, except one, were of a septic and destructive character, they were, for the sake of simplifying the statistical table, included under the heading of pyonephrosis.

Examination of the table will suggest many paths for reflection. It must suffice to call attention to its most salient features. The most important one is this, that roughly speaking the mortality following secondary nephrectomy was twice as large as that subsequent to the primary operation.

In at least two of the fatal cases of secondary nephrectomy (Hospital Reports, 1901, p. 320, Philip E. and Hospital Records, 1909-10, x, p. 1478) it must be admitted that it was an error not to extirpate at once rather than merely to drain the kidney. I now believe that here primary ablation would have offered a better chance of success. But it must be said, that in two of the cases death was due to uræmia, in one coming on long after the discharge of the patient, caused by the diseased condition of the remaining kidney. Furthermore, the study of our histories will demonstrate, that in almost all of the cases of secondary nephrectomy (including patients recovered and dead), the patient's condition at the time of the primary nephrotomy was so precarious, that even this, the milder procedure, constituted a very great risk. It is plausible to assume that had primary nephrectomy been insisted on in all cases (except the two cited above), a good number of those patients would have succumbed, who survived both the milder primary and the severe secondary operation. Therefore it would be very rash to conclude that primary nephrectomy is the safer operation under all circumstances.

The following history is typical for illustrating the necessity for discrimination, where the patient's general condition is very bad.

CASE VI.—*Calculous pyelonephritis of the left side. Nephrotomy. Extraction of large calculus. Drainage. Late nephrectomy. Cure.* (*Hospital Records*, 1899, p. 205.)

Amalia Z., age twenty-eight, admitted July 1. Difficulties of urination since childhood. Since three years urine turbid and offensive. Was recently delivered of child. In May began to feel acute pain in left loin with periodical attacks of high fever, and had become very anæmic and frightfully emaciated. Urine loaded with thick, ropy masses of pus, acid, fetid; no casts, no sugar, traces of albumin. In the left loin a smooth, movable, painful, non-fluctuating mass, extending to the level of the umbilicus. Right kidney palpable, not enlarged, nor painful. Other organs normal. July 2: Nephrotomy, evacuation of a large quantity of fetid pus, and of a uratic stone, two and a half inches long, three-quarters of an inch thick, bifurcated at one end and tapering at the other. Drainage. Though no parenchyma was left, patient's weakness demanding haste, nephrectomy was refrained from. It was expected that establishment of drainage, an easy matter in a simple uncomplicated sac, would lead to cessation of hectic fever and to an improvement of the general condition; and further, that nephrectomy done on a contracted sac would be easier and less shocking than at present. These expectations were all fulfilled. July 14, patient was sent home to recuperate. October 25, readmitted in a remarkably improved general condition, having gained over 30 pounds of flesh, with the urine abundant, clear, acid, containing sparse pus-cells. The mass was much shrunken, drainage sinus discharging moderately. October 26, rapid and easy nephrectomy, isolated ligature of vessels. November 6, discharged cured. December 6, presented herself perfectly well.

While it is an error not to remove at any risk and at once an organ, which is the seat of disseminated undrainable mischief, such as multiple miliary or larger foci of septic destruction from whatever cause, it will on the other hand be advisable to establish preliminary drainage, where the kidney has become a simple pus sac, and especially where the patient's general condition is precarious and the removal of the sac presumably difficult on account of its size and possible close adhesions.

In conclusion we may then say that the larger percentage of mortality in secondary nephrectomy—cases of error of diagnosis excepted—is fully explained by the fact, that here we had to deal with inherently grave conditions, both because of a deep deterioration of the general condition, and because prolonged suppuration had led to the formation of extensive, dense adhesions. It has been asserted that the establishment of drainage was the cause of these close adhesions. This assertion, however, has never been proven, nor is it in accordance with established experience. It is far more likely that effective drainage of a closed pus sac will not only stop fever, but will tend to arrest the new formation of adhesions. It may even lead to the decrease of their extent and density.

Examination of the statistical aspect of things from a different stand-point will disclose another interesting fact. While it was seen that the ratio of mortality in primary and secondary nephrectomies stood as 10.34 per cent. to 19.35 per cent., that is about like 10 to 20, the ratio between the combined number of all nephrectomies (primary and secondary) done for suppurating stone kidney, and all nephrectomies (primary and secondary) done for non-calculous pyonephrosis (hemorrhagic infarcts included) was as 20.5 per cent. to 9.7 per cent. Here again we may say roughly speaking, that the mortality following both primary and secondary nephrectomy done for *calculous* disease is more than double that following operations (primary and secondary) for *non-calculous* suppuration. Here also the explanation must be sought for in the fact, that in calculous disease we invariably have to deal with cases of old standing, involving prolonged suffering and loss of strength, while the majority of the non-calculous cases is composed of instances of an acute invasion of short duration, most of the patients having been in good health up to the recent onset. While in the first grouping the proportion is dependent upon both inherent and relative factors, in the latter it is due only to intrinsic conditions, and is absolute.

CASE HISTORIES.

Primary Nephrectomy for Calculous Pyonephrosis.

CASE VII.—*Calculous pyelonephritis of the right side. Cystoscopy. Nephrectomy. Cure.* (Contribution, *loc. cit.*, p. 696.)

E. W. A., age thirty-eight years, merchant, admitted October 13, 1896. Twelve years ago internal urethrotomy for rebellious gleet and stricture. This was followed by acute cystitis, which had persisted ever since that time. Suffered for ten years from periodical attacks of severe renal colic of the right side, accompanied by chills and bloody urination. In spite of ravenous appetite, emaciated to a skeleton. Since ten weeks urine putrid, and from that time on continuous fever, frequent chills, night-sweats, and incessant lumbar pain, radiating toward bladder and right testicle. Urination very frequent. Physical examination: Excessive emaciation and light anasarca of the feet; otherwise normal conditions; an accelerated pulse of good quality. In right loin a large, sensitive, resistant tumor, which descended to the level of the navel and extended to the median line. Urine foul, acid, containing much pus, some blood, and large quantities of detritus; daily quantity about 50 ounces. Temperature 100.2° F. in the morning, with regular evening exacerbation. October 14, cystoscopy. Trigonum moderately congested, especially around the orifice of right ureter, from which a solid plug of pus was seen escaping. From left ureter clear urine. Left kidney could not be palpated. Assumption was fairly justified that this kidney was sound. Operation October 15, 1896. Chloroform; tumor exposed and easily separated from adhesions. Represented a thin-walled sac from which aspirator removed foul pus, and within which a number of stones could be felt. Cortex appeared waxy. Mass ligation and ablation. During the first 24 hours following operation 50 ounces of clear urine voided. From October 18 temperature became normal. Urine continued to be abundant, and patient's general condition, aided by enormous appetite, was rapidly improved, so that on November 15 was discharged cured, having gained 34 pounds in weight.

CASE VIII.—*Renal calculus; pyonephrosis; nephrectomy; cure.* (*Hospital Reports*, 1899, p. 208; 1898, vol. ii, p. 269.)

Blanche W., admitted July 16. Since five months had severe pain in right side of abdomen. Lost flesh and strength. Urine

contained small amount of albumin, pus, no casts. On right side of abdomen a large, hard, painful, movable mass. It could not be positively determined whether it originated from liver or right kidney. Left kidney could not be palpated. July 18: Exploratory cœliotomy at edge of right rectus muscle; mass found to be the kidney. Abdominal incision closed and nephrectomy performed. Kidney separated from surrounding structures with considerable difficulty. Elastic ligature. Gained rapidly in general condition. Discharged August 13, cured.

CASE IX.—*Ascending pyonephrosis. Nephrotomy. Cystoscopy. Nephrectomy. Cure.* (*Hospital Reports*, 1901, p. 338; 1900, vol. ii, p. 562.)

Herman I., clerk, twenty-two years old, contracted a sharp gonorrhœa 16 weeks ago, which about a week after inception extended to bladder, causing painful and frequent micturition. Gradually left loin became painful, and high fever set in with chills and sweats. Urine became loaded with pus. In another hospital left kidney was incised and drained. Since then regained flesh and strength to a certain extent, but renal fistula annoyed him. Admitted September 11, 1900: General condition good, organs of chest and abdomen normal. Both lumbar regions somewhat tender to palpation; left kidney not to be felt, lower pole of right kidney palpable. In left lumbar region a scar, within which a sinus discharging purulent urine. Temperature in morning 100.8°, at night 103.2°. September 12: Gleet present. Considerable quantity of urinous pus escaped from sinus during the night. Methylene blue injected into sinus did not appear in urine voided from bladder. Urine: acid, specific gravity 1009, marked albumin, no sugar, no casts, plenty of pus. September 18, cystoscopy: much pus flowing out of left ureter. September 18: Pain in right loin, radiating to right shoulder. Up to September 26 occasional fever, otherwise condition unchanged. September 27: Nephrectomy. Chloroform. After development and incision of kidney, catheter was passed without difficulty down into bladder. Ureter cut off about two inches below level of iliac crest. Elastic ligature. Removed kidney, a large, thin-walled sac with smooth lining, in which there were a number of areas containing calcareous deposits; no kidney substance recognizable. Course of convalescence uneventful and afebrile, patient passing very large quantities of

urine, varying between 63 and 75 ounces per day. In the beginning urine still contained much pus, but by October 14 this began to diminish. General condition improved rapidly. October 27, ligature came off. October 29, urine clear, acid, 1014, trace of albumin, very few pus-cells, no kidney elements. November 4, discharged cured.

CASE X.—*Calculous pyelonephritis. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 170; 1902-1903, vol. iii, page 374.)

Jennie S., age eighteen, admitted December 20, 1902. For five years periodical pain in right loin. Urine cloudy, becoming clearer at rare intervals. During last two weeks fever, chills, frequent micturition, constant pain in right loin, with night sweats and loss of strength and weight. On admission, general condition fair. Temperature 101.6°; pulse 34. Internal organs normal. In right loin a large rounded tumor, which was tender to pressure. Cystoscopy: large amount of pus issuing from right ureter. Urine, acid, 1018, albumin, much pus. December 22, 1902: Nephrectomy. Kidney much enlarged, pelvis distended, containing large, rough, black calculus, and foul pus. Cortex one-half inch thick, whitish in appearance. No tubercle bacilli. Uninterrupted convalescence. January 17, 1903, discharged cured.

CASE XI.—*Calculous pyonephrosis. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 171; 1902-1903, vol. iii, p. 390.)

Yetta C., age thirty-five, admitted March 20, 1903. Illness of three months' duration. Acute onset with pain in right loin, radiating down along ureter. Urine turbid. Vomited frequently, had fever and chills, and frequent urination. On admission, general condition fair, internal organs normal. Whole right side of abdomen rigid and tender; in the loin down to the crest of ilium a firm, nodular, tender mass, movable with respiration. Urine: intermittently cloudy, containing traces of albumin, acid, 1031, and pus when cloudy. Diagnosis, calculus pyonephrosis. March 23, 1903: Nephrectomy. Kidney large, cortex thick, pale, and œdematous, with small punctate yellow foci; spreads from these foci showed pus, no bacteria. Pelvis and calices much dilated, containing gray fibrinous clots and a rough, brown stone. Uninterrupted recovery. May 4, 1903, discharged cured.

CASE XII.—*Calculous pyonephrosis. Nephrectomy. Cure.* Typical case of no special interest. (*Hospital Reports*, 1905, p. 174; 1903-1904.)

CASE XIII.—*Calculous Pyonephrosis of right side. Primary nephrectomy. Death.* (*Hospital Record*, 1897, ii, p. 1131, 6.)

Lena W., age twenty-four, miscarriage six years ago. Since nine months, "chills and fever" with attacks of paroxysmal pain in right side. Two weeks ago puncture made below eighth rib posteriorly (in medical ward) yielded pus. Declined incision. Admitted November 19, 1897. Continuous remittent fever, with great emaciation. Right loin occupied by a large tumor, that pushed diaphragm up to sixth interspace and extended downward three fingers below border of ribs. Spleen large and tender. Urine: 1018, much pus, no sugar. Urea $8\frac{1}{4}$ gr. to the ounce. Pulse weak, 80–92. Diagnosis, Pyonephrosis. Nephrectomy, November 27: Long oblique incision. Fluctuating sac punctured, needle struck stones and withdrew pus. Incision and evacuation of large mass of pus. Packing. Peritoneum reflected and vena cava exposed. Fatty capsule stripped off easily except at upper pole, where there was extensive, dense adhesion to diaphragm. Resection of tenth and eleventh ribs, accidental injury of pleura; suture of pleura. Sharp division of adhesions to diaphragm. Following vena cava, vessels were exposed; ureter and vessels tied and cut. Little hemorrhage; nevertheless deep collapse, lasting until next day. High fever followed, spleen became larger and painful; septic symptoms. Urine remained ample and became clear. Died in coma November 29. *Autopsy*: several fresh infarcts of spleen and pneumonia of right lower lobe.

CASE XIV.—*Calculous right pyonephrosis. Nephrectomy. Cure.* (*Hospital Records*, 1908–1909, vii, p. 920.)

Mary M., age thirty-five, housewife, admitted January 27, 1908. Since first confinement, 16 years ago, had urinary difficulty. Two years ago first renal colic. Since two months constant dull pain, no paroxysms, but frequent fever, and loss of 40 pounds in weight. On admission: in right loin large mass reaching two inches below level of umbilicus. Evening temperature 101.8° F. Urine turbid, acid, 1010, loaded with pus. By ureteral catheter: right side urea 0.5 per cent., left side 1.6 per cent. Urine from left side clear. January 30: subcapsular nephrectomy. Elastic mass ligature. As the mass had extended very high up under ribs and toward median line, and as the peritoneum was closely adherent to anterior surface of the mass,

and could not be stripped off without injury, this (the peritoneum) was longitudinally incised, and re-attached by suture, $2\frac{1}{2}$ inches beyond the mesial line of adhesion. Then the mass together with the adherent peritoneum was raised up, and thus the very short vessels of the pedicle became accessible. Ligature came away February 15. Uneventful recovery. Discharged cured, March 19, 1908.

Note.—Good example of treatment of closely adherent peritoneum.

CASE XV.—*Calculous pyonephrosis of right side, exploratory laparotomy; nephrectomy. Cure. (Hospital Records, 1907–1908, vii, p. 944.)*

Bertha C., age fifty, Russian, housewife. Admitted September 7, 1908. For two and a half years frequently recurrent attacks of right lumbar pain with fever, chills, vomiting, frequent urination, and night sweats. Had lost much flesh. On admission, in right loin large elongated, soft, and very movable tumor, which was tender. Pulse 110, temperature 101° F. Urine: amber, cloudy, neutral, little albumin, loaded with pus. September 12: Probatory laparotomy. This having dispelled any doubt as to the seat of the tumor, the peritoneal incision was closed; then tumor was exposed by lumbar route. Easy exposure of vessels, separate deligation. Kidney of large size, containing several calculi and much pus, both in pelvis and disseminated through parenchyma. October 1, discharged cured.

CASE XVI.—*Calculous pyonephrosis of right side. Renal calculus of left side. Right nephrectomy. Subsequent left nephrolithotomy. Cure. (Hospital Records, 1907–1908, vii, p. 945.)*

Celia R., age twenty-nine, housewife, Russian, admitted, September 18, 1908. Twenty years ago, attack of sharp pain in right loin with vomiting and fever. Seven years ago typhoid, following which had a similar attack, which laid her up for two weeks; urine frequently bloody. Four days ago the last, very violent attack with chill. Urination was never frequent or painful, but urine was very turbid. On admission, temperature 104.2° , pulse 120. In left hypochondrium a large, very tender mass; rigidity of muscles preventing satisfactory palpation. Cystoscopy. Normal bladder. Right ureter, a few drops of thick pus. Left ureter, amber, turbid, loaded with pus, urea 1.4

per cent. Combined urine, amber, acid, 1016, albumin. Radiograph: shadows, denoting calculi in both kidneys. September 19, right nephrectomy. Resection of twelfth rib. Kidney a huge sac containing pus and a large triangular calculus. Rubber ligature, which came off October 10. October 14, left nephrectomy and extraction of oval renal calculus $2\frac{1}{2}$ inches long. Uneventful recovery. Discharged cured, November 18, 1908.

Note.—Remarkable on account of successful attack on both kidneys.

CASE XVII.—*Calculous pyonephrosis of left side. Nephrectomy. Cure.* (*Hospital Records*, 1908–1909, vii, p. 1103.)

Antonia O., age forty-one, seamstress. Russian. Admitted June 24, 1909. November 23, 1905, was operated upon in this hospital for acute osteomyelitis of humerus and suppuration of shoulder-joint. Discharged February 8, 1906. While in hospital had attack of pain in loin. Kidney was palpable and painful. Since last four months had recurrent left lumbar pain, radiating to genitals. Urination never frequent or bloody. Had lost 30 pounds in weight. On admission: temperature 102.6° F., pulse 100, right kidney not palpable, in left loin tumor of the size of a fist, tender, somewhat movable. Cystoscopy: Trigonum congested. Ureteral orifice easily found. Pressure on left kidney expelled cylinder of pus from left ureter. Right kidney discharging plenty of clear urine. Urine, amber, cloudy, acid, 1016, loaded with pus, no blood. Radiography yielded negative result. June 29, nephrectomy. Evacuation of a number of large renal abscesses by incision to reduce size of tumor. Separate ligation of vessels. Specimen: No parenchyma left. Kidney a system of abscesses; in pelvis a flat stone of large size. Uninterrupted recovery. Discharged cured July 13, 1909.

CASE XVIII.—*Calculous pyonephrosis of right side. Nephrectomy. Cure.* (*Hospital Record*, 1909–1910, vol. x, p. 1453.)

Minnie W., age $15\frac{1}{2}$. United States. Admitted May 26, 1910. Since two years constant pain in right loin, with frequent colicky accentuation. Pain most severe at night. Urination normal. On admission, temperature 99° F., pulse 94. In right loin a large, hard, somewhat nodular and tender mass, extending below umbilical level. Cystoscopy: Cystitis. Catheters passed readily; from right side no secretion whatever; from

left side normal looking urine, amber, clear, acid, containing 2.5 per cent. urea. Radiograph: several calculi. June 4, nephrectomy. Delivery of tumor, vessels separately tied. Specimen: Dimensions of organ, $7\frac{1}{2} \times 4 \times 3$ inches; on section, a system of pus sacs, without kidney tissue, with several calculi. Uneventful recovery. Discharged cured, June 18, 1910.

CASE XIX.—*Calculous pyonephrosis of left side. Subcapsular nephrectomy. Cure.* (*Hospital Records*, 1909-1910, x, p. 1455.)

William B., age forty-two, driver, United States. Admitted April 4, 1910. Gonorrhœa 18 years ago. For past seven years had at long intervals attacks of pain in left loin. The last six weeks constant lumbar pain, radiating into left groin. Urination frequent and turbid; had lost ten pounds in weight. On admission temperature 100° F., pulse 84. Kidney-shaped large mass in left loin. Urine, amber, turbid, alkaline, 1020, loaded with pus. Cystoscopy, right side, abundant clear urine; left side, no secretion whatever. Radiograph: several calculi in left kidney. April 7: Difficult subcapsular nephrectomy. Capsule enormously thickened, of cartilaginous consistency and in places one inch thick. In stripping the capsule off the parenchyma, several abscesses were opened. Elastic mass ligature. After cutting away the kidney, a calculus was found to be in the grip of the ligature. Application of another ligature higher up. A large branching calculus was found in pelvis. No parenchyma left. Uneventful recovery. Discharged cured May 22, 1910.

Note.—Remarkable thickness of fibrous capsule.

CASE XX.—*Calculous pyonephrosis of left side. Nephrectomy. Cure.* (*Hospital Records*, 1909-1910, vii, p. 1454.)

Joe G., age fifty, presser, Russian, admitted July 26, 1910. In December, 1908, had exploratory nephrotomy performed at this hospital. Specimen was removed from parenchyma and interstitial glomerular nephritis was found by pathologist. Ever since discharge had dull and constant pain in left loin, frequently augmented to sharp attacks of renal colic, radiating into testes and thigh. Urination frequent and painful. Urine turbid, sometimes bloody. On admission, pulse and temperature normal. Large scar in left loin. Kidney could not be felt. Cystoscopy: both ureteral orifices normal. Clear urine from right side. No

urine from left side. Combined urine: amber, turbid, acid, 1022, full of pus. Radiograph. Calculus in left kidney. August 2, extracapsular nephrectomy. Very difficult isolation on account of dense adhesions and a short pedicle. Elastic ligature applied with much difficulty. Cutting away of mass through parenchyma. Space thus gained, another elastic ligature was applied beyond parenchymatous rests and these were trimmed away. Specimen: a shrunken, degenerated kidney, containing one calculus. Ligature came away on twenty-fourth day. Uneventful recovery. Discharged cured September 11, 1910.

CASE XXI.—*Right pyonephrosis, nephrolithiasis, chronic nephritis of left kidney. Nephrectomy. Death from uræmia. (Hospital Records, 1904-1905, iii, p. 492.)*

Annie Sch., age thirty-four, Russian, housewife, four children. Admitted May 18, 1905. Renal colic since fifteen years. Recent development of tumor with fever and emaciation. Very irritable bladder. Cystoscopy: Right ureter furnished no urine whatever, only very thick pus; left, scanty, very pale urine, 1008; urea total 24 hours, 5.4 grammes. No tuberculosis. Heart: mitral insufficiency and stenosis. In right loin large, hard tumor. May 15, typical nephrectomy: separate ligature of vessels. Kidney five inches long, $3\frac{1}{2}$ inches thick, distended with pus, containing branched mulberry stone. No parenchyma left. May 16: somnolence, very scanty urine, finally anuria. May 17, death. Autopsy not obtained.

CASE XXII.—*Primary nephrotomy for non-calculous pyonephrosis, caused by infarct. Suppuration of renal infarct. Nephrectomy. Cure. (Hospital Report, 1903, p. 161.)*

Mabel F., age twenty-four; married; nullipara. No history of previous renal trouble. Ten days ago paroxysmal pains in right loin, radiating to bladder. Vomited all ingesta. Was in bed for four days. Day before admission had severe chill and fever. On admission, November 5, 1900, good general condition. Lungs and heart normal. Abdominal parietes of right side rigid. Pressure in right hypochondrium and lumbar region very painful; resistance was felt there, lower border of which extended to umbilicus. Appendicitis and cholecystitis were excluded; presence of the lumbar pain determined us to look for the trouble in the right kidney.

November 7, nephrectomy (chloroform): During induction

of anæsthesia severe epistaxis, necessitating tampon of anterior and posterior nares. Oblique right lumbar incision. Puncture of exposed kidney yielded blood. Near anterior angle of wound peritoneum was sufficiently incised to permit exploration, demonstrating that the abdominal organs were normal; after closure of this incision kidney was delivered. It was of normal size and distinctly lobulated. Occupying the middle lobe, in wedge shape, was seen a discolored pyramidal area of reddish-brown tissue. This being laid open by an incision along the convexity, was found to be interspersed with streaks of yellowish pus. Wedge penetrated entire thickness of the pyramidal and cortical tissue. Vessels isolated and separately secured with silk; ureter was then drawn out and divided at a distance of about four and a half inches from its renal end, and its distal end ligated; gauze drainage of stump; wound closed with button suture. Uneventful recovery. Discharged cured December 5, 1900.

CASE XXIII.—*Ectopic sacral kidney the seat of acute inflammation. Nephrectomy. Cure. (Hospital Report, 1903, p. 256; 1902, vol. ii, p. 332.)*

Joseph S., age twenty-nine, cloakmaker. Had an attack, similar to the one for which he came to hospital, ten days before. Present illness commenced 24 hours before admission; was marked by severe pain in both lumbar regions, radiating into groins. No chill, but fever; vomited several times. Urination frequent and painful; no hæmaturia.

On admission, October 9, 1902: Fair general condition; lungs, liver and spleen normal. Heart: Disease of aortic and mitral valves. Abdomen: Entire right side rigid, lower half especially so; no free fluid; no tumor felt (on account of muscular rigidity); per rectum, high up above prostate, large, indefinite mass could be palpated. Temperature 103.4°, pulse 104. Immediate operation was thought necessary, as acute empyema of the appendix could not be excluded. Abdomen opened at right side by Kammerer incision. Appendix found free and normal in appearance; it was removed. Exploration revealed mass in the median line, over the lumbo-sacral junction, covered by peritoneum. In Trendelenburg's position mass was exposed; its peritoneal covering was split longitudinally. The mass was recognized as a kidney; was

firmly lodged at the lumbosacral junction; its vessels came from the aorta in two large branches; was cubical in form, hilus to inner side; the veins ran lengthwise along the hilus; no marked surface depression. While examining the organ a large renal vein was torn. The cortex was so friable that with the most gentle manipulation a deep rent into it was made. The bleeding from these sources was very profuse, and could not be controlled by clamp or tampons. After determining the presence and consistence of remaining kidney by palpation through abdominal wound, nephrectomy was done. Pedicle secured with heavy catgut. Some aberrant arteries at upper pole were ligated. Cigarette drain to stump; layer suture of abdominal wall. Uneventful convalescence. Pathologist's report: Acute degeneration and inflammation of kidney.

CASE XXIV.—*Chronic pyelonephritis and renal atrophy of right side; hemorrhagic infarcts. Nephrectomy. Cure. (Hospital Records, 1906-1907, vii, p. 827.)*

Sam K., age twenty-eight, laborer, Russian. Gonorrhœa nine years ago. Five years ago had severe pain in right loin, for which (in another hospital) an exploration was made, when the kidney could not be found and the wound was closed. Pain radiated to genitals, the urination was frequent and bloody, and there was vomiting. Since then frequent similar attacks with chills, fever, and vomiting; urine very turbid. Two weeks ago last attack with hæmaturia. On admission, kidneys could not be felt, severe pressure pain and tenderness in right loin. Temperature and pulse normal. Urine: amber, acid, 1022, pus, a few blood-cells, much oxalate of lime. Cystoscopy: bladder normal. Right ureter and pelvis readily entered by catheter; no secretion whatever. Left ureteral secretion 4 drachms; accidentally lost. December 4, nephrectomy: Oblique incision. Only the lower pole of the kidney could be felt at end of inspiration, high up under the costal border. Resection of eleventh and twelfth ribs. A small, hard and lobulated kidney was delivered with much difficulty. In upper pole a cyst, all over surface of cortex yellow patches of old infarct. As it was a "dead" kidney, it was deligated (elastic ligature) and removed. Pathological report: hemorrhagic infarcts; interstitial nephritis; marked endarteritis. Uneventful recovery. Discharged cured, January 6, 1907.

CASE XXV.—*Pyonephrosis from multiple septic infarcts of right kidney. Nephrectomy. Cure.* (*Hospital Records*, 1908–1909, vii, p. 940.)

Jenny K., age thirty, housewife, Russian, admitted January 25, 1908. In May, 1904, was in gynæcological service, when pyelitis was noted. At that time had a sharp renal colic during pregnancy. Two weeks ago sudden severe pain in right loin with fever and frequent voiding. Four days ago return of pain with increased severity and fever; had two chills and vomited. On admission: Pulse 140, temperature 103.4°, general condition good, much tympany, except in right flank where there was extended dulness. Muscles of right flank and hypochondrium very rigid; pressure caused much pain and resistance, but mass could be felt. Left side of abdomen lax. Ureteral catheterization: Right side, amber, turbid, neutral, albumin, no pus, urea 0.3 per cent.; left side, amber, clear, acid, a few red blood-cells, urea 3 per cent. Radiography: No calculus in any part of urinary tract. January 27, nephrectomy: Kidney fat, very œdematous. High fixation of kidney demanded resection of twelfth rib. Pedicle very short, preventing delivery. Rubber ligature. Kidney much enlarged, congested, numerous small abscesses in cortex, also several hemorrhagic foci which had not yet broken down. February 15, ligature came away. Discharged March 10, 1908. Seen in May entirely cured.

CASE XXVI.—*Nephrolithiasis of right side. Nephrolithotomy. Cure.* (*Hospital Records*, 1908–1909, vii, pp. 1091 and 1110; 1909–1910, x, p. 1407, No. 117, 318.) *Multiple septic infarcts and pyonephrosis of right side. Nephrectomy. Cure. Perireteral abscess. Incision. Cure.*

Samuel Z., age twenty-eight, tailor, Austrian. Admitted November 14, 1908. Since two years frequent attacks of sharp lumbar pain of right side provoked by brisk exercise. Urination five to six times per day; no gravel or blood in urine. During attacks voided no urine, but as soon as he lay down, pain ceased and copious urination began. On admission, good condition. Pulse and temperature normal. Kidneys could not be palpated. Urine: amber, turbid, acid, 1030, red blood-cells. Radiograph showed presence of calculus in pelvis of right kidney. November 10, pyelotomy: extraction of stone from pelvis and nephrotomy for extraction of small stone from a calix. Drainage. December 6, 1908, discharged cured.

Readmitted April 22, 1909. In January, 1909, renal colic of right side. April 25 sharp paroxysmal attack of pain in right side of abdomen. Very frequent urination, vomiting, no hæmaturia. On admission, temperature 106° F., pulse 120. Vague tenderness in right loin and hypochondrium on pressure. Urine: Amber, cloudy, acid, 1012, hyaline and granular casts, pus-cells and a few red blood-cells. Cystoscopy right side: A great number of pus-cells, a few red blood-cells, urea 2 per cent.; left side: Many red blood-cells, hyaline and granular casts, urea 4 per cent. Radiograph negative. April 23, nephrectomy. Kidney deeply and firmly imbedded in cicatricial adhesions. Pedicle too short for delivery, twelfth rib resected to gain exposure. Difficult placing of elastic ligature behind closely adherent kidney, which was extremely friable, demanding careful manipulation. Kidney cut away through parenchyma adjoining pelvis, then all adhering parenchyma was trimmed away from pedicle with scissors. Mikulicz tampon. Specimen: The entire kidney riddled with softening infarcts. May 25, discharged cured.

Readmitted September 1, 1910, when a large periureteral abscess was incised and drained by a section running parallel to and above Poupart's ligament, the peritoneum being stripped up, and the abscess thus entered and drained. October 10, discharged cured.

CASE XXVII.—*Pyonephrosis of right side. Nephrectomy. Septic nephritis of left kidney. Death. (Hospital Reports, 1903, p. 165.)*

Annie S., age thirty-eight. Ten weeks ago began to feel severe pain in left side, accompanied by flow of bloody vaginal discharge. Cured at King's County Hospital, Brooklyn; stayed there six weeks. Had lost very much flesh. On admission, September 2, 1909: Emaciated. In right lumbar region a mass the size of a child's head, movable, hard, non-fluctuating, tender, showing balottement. Pulse and temperature normal. Urine: Pale amber, 1006, albumin, loaded with pus, no casts. Urea 1 per cent. Daily quantity 20 ounces. Cystoscopy, turbid urine from both ureters. September 6, nephrectomy: Peritoneal reflection exposed, incised, and other kidney palpated. It was of normal size and consistency. Difficult development of right kidney. Rubber mass ligature; Mikulicz tampon. Duration of operation 40 minutes. Patient did not react well, very restless, temperature 103.6°, pulse 144. Urine 21 ounces in 24 hours,

loaded with pus, granular and hyaline casts. September 10, died.

Autopsy.—Left kidney lobulated, capsule not adherent; marked degeneration, acute congestion; cortex swollen, containing numerous hemorrhages. Peritoneum normal.

CASE XXVIII.—*Pyonephrosis of left side. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 172, 1903-1904.

Admitted, June 1, 1904. Since one year suffered with continuous pain in left loin, cloudy urine, and painful micturition. General condition poor. Left kidney enlarged, white blood-cell count 25,800, temperature 101.4° F., pulse 104. Combined urine, acid, 1020, loaded with pus. Cystoscopy: Right ureteral orifice dilated, the left one plugged with pus, a mucous ulcer near it. Urea of combined urine 2.2 per cent. June 4, nephrectomy. Kidney: Double the normal size, very adherent, filled with foul pus. Uninterrupted recovery. Discharged cured, July 14, 1904.

CASE XXIX.—*Pyonephrosis of right side. Perinephric abscess. Empyema of ureter. Incision and drainage of perinephric abscess. Nephrectomy. Ureterectomy. Fecal fistula. Cure.* (*Hospital Reports*, 1905, p. 172; 1903-1904, vol. iii, pp. 376 and 392.)

Morris M., age thirty-eight, admitted July 29, 1903. Present illness began two months ago with severe sticking pains in right loin, chills, fever, sweating, and constipation. On admission: Internal organs normal; no tumor felt in right loin, but complained of marked tenderness and pain there. Urine: acid, cloudy, with much pus; no tubercle bacilli. Temperature 103.1°; pulse, 130. July 31: Incision of perinephric abscess. Suppuration of abscess cavity diminished, but discharge became distinctly urinous, and pyuria continued unabated. September 10, nephrectomy: Kidney lobulated, enlarged, pale; pelvis and calices much distended by pus; cortex extremely thin. Wound healed normally, but pyuria still continued. October 16: Cystoscopy: thick pus descending from right ureter. Left ureter appeared normal; considerable cystitis. October 19: Ureterectomy for empyema of ureter, which was found to be a thick-walled, elongated sac of the dimensions of a small intestine, filled with thick pus. Extirpation offered great difficulty on account of intimate adhesions to peritoneum and to posterior wall of the ascending colon, demanding constant use of knife. After-treatment com-

plicated by considerable sloughing, as a consequence of which, on October 29, a colic fistula established itself. January 11, 1904, fistula was closed by plastic operation. General condition improved visibly after this, though intense cystitis persisted and remained rebellious to every known form of treatment. February 9, discharged improved (with cloudy urine). April 26, readmitted. Cystoscopy demonstrated intense cystitis. Under the assumption that a stump of right ureter might be the cause of continued trouble, on May 2 posterior surface of bladder exposed by parasacral route. Careful exploration revealed assumption unfounded. June 6, discharged with unabated cystitis.

CASE XXX.—*Metastatic pyonephrosis of right side. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 173; 1903-1904, vol. iii, p. 377.)

Julia T., age twenty-two, admitted February 6, 1904. Present illness of one month's duration, characterized by dull pain in right hypochondrium and loin, frequent voiding of cloudy urine, night sweats, fever, and loss of flesh. Before onset, had had paronychia of thumb looked upon as primary focus of infection. On admission, general condition fair, internal organs normal. In right loin an ovoid, smooth, hard, and tender mass. Urine: acid, 1020, trace of albumin, 2.5 per cent. urea, a few hyaline casts, some pus. Cystoscopy: normal bladder, ureteral orifices normal, catheterization of both ureters easy. No urine obtained from right side; that from left kidney was acid, clear, had a trace of albumin and some hyalogramular casts. Cryoscopic index 1.7. February 8, 1904, nephrectomy. Kidney bathed in a perinephric abscess, parenchyma totally disorganized by many abscesses, so that the organ had to be removed piecemeal. March 12, discharged cured.

CASE XXXI.—*Metastatic pyonephrosis. Perinephric abscess. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 174.)

Walter B., age twenty-four, admitted July 15, 1903. Six weeks before onset had had small infected wound of toe. Two weeks later began to feel pain in left iliac region radiating toward groin, with chills and fever. Urination not disturbed. July 3, family attendant had incised abscess pointing in rectum. Lost much flesh and strength. On admission, July 15, poorly nourished, internal organs normal. In left loin a large, tender mass. Temperature, 103.2°; pulse, 96. Combined urine, acid, 1018,

trace of albumin, much pus, few red blood-cells; 2.5 per cent. urea. Cystoscopy: normal bladder, except for some injection around left side of trigonum. Both ureteral orifices normal. Right catheter easily introduced; left catheter impeded one-half inch from orifice. Urine: right kidney, acid, faint trace of albumin, 2.0 per cent. of urea. July 18, incision of perinephric abscess. Transient abatement of fever. July 27, severe chill, temperature 104.6°. Frequent repetition of chills with high fever. August 1, nephrectomy. Kidney enlarged, containing two large purulent infarcts, one in lower section, the other in middle of organ. Immediate recession of fever. Uninterrupted recovery. September 21, discharged cured.

CASE XXXII.—*Acute ascending (gonorrhæal?) pyonephrosis. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 170; 1902-1903, vol. iv, p. 378.)

Albert R., age twenty-three, admitted April 27, 1903. Had gonorrhœa one and a half years ago. Four months before had attack of grippe. Sudden onset of pain in right loin. Ever since gonorrhœa had very frequent urination, night sweats, and had lost 29 pounds. On admission, general condition poor, internal organs normal, in right loin a movable, tender, rounded mass of uneven surface. Urine: acid, 1028, albumin, pus abundant. Cystoscopy: bladder normal, both ureteral orifices congested, clear urine descending from left ureter, masses of pus from the right one. Catheter passed easily into left ureter, but was arrested in right ureter one-half inch from bladder. Deep urethral stricture of large calibre. Left kidney discharged acid, albuminous urine, with one and a half per cent. of urea, pus-cells and a few red blood-cells. Right kidney yielded only pus. May 1, 1903, nephrectomy. Kidney very large, lobulated, everywhere adherent. Its structure entirely disintegrated by numerous abscesses. Pelvis much dilated by pus. Ureter thickened, œdematous, its lumen narrowed, mucous lining hyperplastic and ulcerated. Uninterrupted recovery. May 31, discharged cured.

CASE XXXIII.—*Pyonephrosis of right kidney. Perinephritic abscess. Incision and drainage. Nephrectomy. Cure.* (*Hospital Records*, 1908-1909, vii, p. 941.)

Joseph L., age ten years, school boy. Admitted August 31, 1908. Four weeks ago sharp pain in right loin, non-radiating, no frequency of urination. Since a week fever and chills. On

admission in right loin a mass, extending to level of umbilicus and to mammary line. Deep fluctuation at lumbar aspect; muscles there rigid; much tenderness. Urine clear, acid, 1030, few epithelial and pus-cells. White blood count 26,600, polynuclears 32 per cent.; temperature 102.6°, pulse 108. September 1: incision and drainage of lumbar abscess, followed by profuse suppuration, remittent fever, and a moderate diminution of lumbar mass. September 16, cystoscopy with small, special instrument anæsthesia and after meatotomy. Bladder normal. Catheterization of both ureters easy, but flow of urine so scanty that no advantage was thus gained. September 29, nephrectomy. Elastic ligature. Kidney permeated by a large number of smaller and larger abscesses. Pus, *Staphylococcus aureus*. Immediate drop in fever. Uneventful recovery. Discharged cured, October 22, 1908.

CASE XXXIV.—*Laparotomy for supposed ureteral calculus of right side. Explorative extraperitoneal ureterotomy (no stone found). Suppuration of wound. Second futile exploration of ureter. Pyonephrosis. Nephrectomy. Cure. (Hospital Records, 1908-1909, vii, p. 1100.)*

Jacob S., age thirty-nine years, tailor, Russian. Admitted December 2, 1908. On April 27, 1907, had entered medical service. Diagnosis chronic appendicitis. Operated upon July 9, 1907. Discharged cured. Readmitted, November 9, 1908. Was well until nine weeks ago, when felt sharp, paroxysmal attacks of pain in right loin radiating into groin and right testis, brought on by violent locomotion, when urine became bloody. Skiagraph showed a small round shadow half an inch from orifice of right ureter. Laparotomy through right rectus to explore course of ureter. No stone could be palpated; closure of wound. November 14, discharged with hope, that very small stone may be voided. Readmitted December 2, 1908. Continued sharp pain in right loin radiating to penis. Painful and frequent urination. Pulse and temperature normal, kidneys non-palpable; deep pressure in right flank and along right ureter painful. Urine, amber, clear, 1030, no blood or pus. December 5, extraperitoneal ureterotomy with negative result. Ureteral catheter passed without impediment to pelvis and bladder. Closure of ureter and of external wound. Suppuration of wound followed and ureteral fistula resulted after incision and drainage on January 2, 1909.

March 10, second futile retroperitoneal exploration. Persistence of ureteral fistula. March 27, high fever set in with acute persistent lumbar pain. March 29, nephrectomy. On section of ureter pus was seen escaping from lower segment. Separate ligation of vessels. Specimen: kidney enlarged; calices and pelvis congested and studded with hemorrhagic areas. Near upper pole several abscesses were found in cortex. May 16, discharged cured with normal urination.

Causes of death in 29 primary nephrectomies for calculous and non-calculous pyonephrosis: (1) septic pneumonia; (2) anuria; (3) septic, acute nephritis of opposite kidney.

SECONDARY NEPHRECTOMY FOR CALCULOUS PYONEPHROSIS.

CASE XXXV.—*Calculous pyonephrosis. Nephrotomy and evacuation of five renal abscesses, each containing a stone. Closure of the wound. Recurrence. Nephrectomy of the calculous kidney. Cure.* (Contribution *loc. cit.*, p. 695.)

Mrs. J. V., age forty, multipara, admitted June 8, 1896; had suffered from persistent hæmaturia five years ago, which ceased spontaneously. A year ago had sharp renal colic, accompanied by fever and vomiting. Shortly after this pus in the urine. Micturition never painful. Since four months continuous pyuria and noticeable emaciation. On admission: large, dense, non-fluctuating tumor in right loin, which protruded into hypochondrium, displacing the colon downward and forward. Urine abundant, acid, 1016, contained large quantities of pus. June 10, cystoscopy. Pale vesical mucous membrane. On gentle massage of the right groin a cylindrical plug of pus escaped from the right ureter, the orifice of which was much congested. Left ureter normal. Into this catheter introduced by Kelly's procedure. Sixteen grammes of urine collected, that contained a few pus-corpuscles and traces of albumin. Hence it was concluded that the left kidney, though not perfectly sound, was not seriously involved.

June 15, right kidney exposed and freely incised. From pelvis and four calices large quantities of pus and several irregular shaped uratic stones removed. Kidney drained. Little reaction. Secretion diminished rapidly, and patient was discharged July 18 with nearly closed wound. General condition had improved

noticeably. October 7, presented herself again, reporting that the wound, which had been closed for several weeks, had reopened a week ago, discharging a large quantity of pus. Lumbar tumor smaller than it was before the first operation, painless to touch; general condition very good, urine acid and abundant, containing much pus. October 22, 1896, nephrectomy. Kidney contained six abscesses, each harboring a stone. Renal parenchyma waxy, very much shrunken. By October 27 urine became nearly normal, though still containing microscopical quantities of pus. November 20, mass ligature of the pedicle came away. December 15, discharged cured.

CASE XXXVI.—*Calculous pyonephrosis of right side; two subsequent nephrotomies with evacuation of pus and stones (at another hospital); nephrectomy. Cure. Uncomplicated case. (Hospital Reports, 1901, p. 199.)*

CASE XXXVII.—*Dystopia renalis with nephrolithiasis. Exploratory laparonephrotomy. Transperitoneal nephrectomy. Death. (Hospital Reports, 1901, p. 330, 1900, vol. i, p. 714.)*

Philipp E., tailor, twenty-two years old, had been suffering for four years from many attacks of severe pain seated in the right side of the hypogastrium, extending into the right iliac fossa, lasting about 24 hours, during which he vomited. The last attack, accompanied by repeated vomitus, began 24 hours before admission. Micturition frequent, not painful. On admission, April 19, 1900: Moderately well-nourished body, thoracic organs normal; the abdominal organs apparently normal, except that there could be felt just below the umbilicus and slightly to its right side a fusiform, hard and tender, non-movable body, the lower portions of which could not, during bimanual rectal palpation, be brought within the grasp of the fingers. Kidneys could not be palpated. Mass not influenced by respiration. Urine clear, acid, 1030, trace of albumin, pus-cells, red blood-cells, bladder epithelia, and mucus. Temperature 100.8°. April 23, cystoscopy. Trabeculated but otherwise normal bladder, normal ureteral apertures. With these data a satisfactory diagnosis of the tumor was not possible. The symptoms pointed to nephritis, but the presence of a patent urachus, in open communication with the bladder, was also thought of, though no signs of such an aperture could be found by cystoscope. Fever and intense paroxysmal pain in tumor determined exploration. April 23,

median incision below umbilicus. Tumor retroperitoneal, closely and immovably adherent to promontory. Peritoneum over tumor incised and stripped off for a distance; profuse hemorrhage. Wedge-shaped piece cut out for microscopical examination. Hemorrhage controlled by parenchymatous suture, the peritoneum closed over mass. Incision of the abdominal wall united. Slight rise of temperature (101.4°). Some vomiting. Wounds healed by first intention. Blood appeared in the urine and made probable that the tumor was a kidney. This was confirmed by pathologist, who reported specimen to be renal tissue in state of chronic interstitial nephritis. Patient declining further operative procedures, was discharged May 17. June 19, readmitted, stating that he had had three severe attacks of pain and vomiting together with fever, each attack lasting several days. Temperature 102.6° , pulse 116, respirations 26. Marked prostration, exquisite tenderness with much increased size of mass. June 19, temperature 105° , pulse 130, urine loaded with pus, pain increasing.

Nephrectomy at 8.30 P.M.; chloroform. Abdomen opened through scar of previous incision, intestines packed away. Retroperitoneal tumor representing kidney isolated. It lay across front of vertebræ, reaching upward to upper border of fourth lumbar vertebra, downward into middle of sacral concavity. Laterally further over to right side than to left. Peritoneum divided and tumor exposed. Left margin convex, right margin concave with pelvis adjoining, in which a stone was felt. This was extracted through an incision. Presence of second kidney ascertained by palpation. Ureter lay in front, vessels behind kidney, tightly held between them. Rubber mass ligatures. Edges of posterior peritoneal incision sutured to those of anterior parietal peritoneal wound. Abdominal parietes closed except at angle, where drainage was provided for. Specimen: organ of shape of truncated cone 10.5 cm. wide at base, 10 cm. high. Both anterior and posterior surfaces crossed each by furrow 4 mm. deep (bed of vessels and ureter). On anterior aspect necrotic area. In cavity of pelvis pus and a stone of good size. Pyelonephritis, surgical kidney. Passed 11 ounces of urine five hours after operation, 1040 , acid, pus, hyaline and granular casts, albumin. Temperature fell to 101.4° F. Urine during first 24 hours 37 ounces. Hiccoughs, vomiting, failing pulse. June 23,

failing, urine 38 ounces, loaded with pus, continued vomiting, icterus, facies hippocratica, temperature 103.2° F., died.

Wound Examination Post Mortem.—Peritoneal sutures intact and united, general peritoneal cavity perfectly walled off, no peritonitis. Left kidney, much congested and enlarged. Acute degeneration and interstitial hemorrhages on a chronic nephritis.

Epicrisis.—It was a mistake not to remove the kidney at the first operation. It might have saved the patient.

CASE XXXVIII.—*Calculous pyonephrosis of left kidney. Perinephritic fecal abscess. Incision and drainage. Nephrectomy. Fecal fistula. Chronic sepsis. Death. (Hospital Reports, 1901, p. 339; 1900, vol. i, p. 853.)*

Rosie B., housewife, thirty-seven years old, multipara. Five weeks ago felt pains in right, later on in left loin, this latter pain remaining until now, relieved by flexion of the left thigh. Pain is of varying intensity, constant. Vomits easily, is constipated. Urine scanty, becoming extremely so during exacerbations of pain. Lost considerable flesh. Admitted February 13, 1900: General condition poor, emaciated, anæmic, tongue coated; bronchial catarrh. Heart, liver, spleen normal. Abdomen tympanitic. In left lumbar region a large, tender, palpable and visible tumor, abdominal wall rigid. Pelvic organs negative; legs œdematous. Pulse 112, respirations 28, temperature 102.4°, rising to 103.4° in the evening. Urine loaded with pus. February 15: Lumbar incision evacuated a large quantity of foul pus from a retroperitoneal cavity extending well down into the iliac fossa. Drainage. Fever moderate after this, never absent; pus remained offensive, often fecal in odor and character. Blood appeared in urine, but soon disappeared from it; the urine continued to contain pus, albumin, daily quantity about 35 ounces. February 22: Chill, with temperature 105.4°; catarrhal pneumonia in lower lobe of lung of the right side. By March 6 this had abated, but cavity was still discharging large quantities of foul, feculent pus; urine continued purulent. Patient evidently suffering from septic condition, due to a disorganized kidney, complicated by colic fistula. As salvation was only possible by removal of kidney and the conversion of irregular and labyrinthine wound into a simple cavity, March 9, nephrectomy.

Chloroform. Oblique incision. An hour-glass-shaped cavity was found, its narrow neck corresponding to a defect in lumbar fascia, which also was freely divided. In upper angle of interior cavity there was an irregular, closely adherent, and extremely dense cicatricial mass (identified as the kidney), containing here and there rudiments of renal tissue. From the centre of this mass a renal calculus of the size and shape of a pigeon's egg was extracted, together with a large quantity of chalky, soft material. To reach the upper limits of this mass, portions of the twelfth and eleventh ribs had to be resected. Intracapsular enucleation of kidney impossible on account of cicatricial deposit of incredible density. Sharp dissection by scalpel and scissors. Previous to this the peritoneal reflection was well exposed, likewise that of the pleura, and by great care injury to both was avoided. As soon as a practicable pedicle had been formed, this was secured by an elastic ligature and the mass was cut off. Communication with intestine not found. Cavity packed, anterior angle of large wound closed by a few button sutures passed through all layers of abdominal wall. Toward end of this severe operation saline infusion of 1000 grammes was made. March 10: Patient rallied well, temperature dropped to 98.6°. Dressings soaked by an enormous quantity of extremely fetid, turbid, feculent material. Urine: First specimen after operation 3 ounces, yellowish-brown and extremely fetid, containing blood and pus, granular casts, and very much albumin. March 25: Ligature came away; though there was no fever, patient visibly growing weaker, urine containing much albumin, red blood-cells, and pus; aversion to every kind of nourishment, is septic. March 29: Temperature 99°. During April wound continued to discharge fæces and pus, and showed no tendency to contract. Alternations of severe rigor and high fever, with normal and subnormal temperatures, the development of bed-sores, an increasing aversion to food, and deepening emaciation, finally led to patient's total exhaustion, which caused her death on May 6.

Autopsy (May 6, 1900).—Incision in left lumbar region just below free border, leading to a cavity, relations of which were difficult correctly to ascertain because of adhesions and extensive inflammatory products present. Attached to upper edge of incision a coil of intestine, which is the descending colon, showing a large defect from which fæces were escaping.

CASE XXXIX. — *Calculus pyonephrosis. Nephrotomy. Nephrectomy. Uræmia. Death.* (*Hospital Reports*, 1901, p. 341; 1900, vol. ii, p. 186.) -

Sarah A., housewife, forty-five years old. For five years frequent, painful urination. Two months ago noticed large tumor in right loin and hypochondrium. Loss of flesh. On admission, June 20, 1900: Emaciated, temperature 101° ; organs of chest and abdomen normal, except that there was in right loin a large, nodular tumor extending down to within two inches of Poupart's ligament, tender to touch, scarcely movable, and little influenced by respiration. June 20: Inflated colon lying in front and to inner side of tumor. June 22, cystoscopy: Bladder of normal appearance, pus escaping from right ureteral orifice. Urine: alkaline, containing large quantity of muco-pus, no casts, no tubercle bacilli. June 25, nephrotomy. Ether. Tumor incised, large quantity of pus evacuated. Tumor still remaining very large, two more abscesses opened through first incision under guidance of finger. Large calculus extracted from pelvis. Edges of pus sac sutured to skin, extrarenal spaces packed with gauze, two drainage tubes inserted in renal pelvis, wound dressed. Toward end of operation pulse became imperceptible; a saline intravenous infusion. June 27: Rallied slowly, passing large quantities of clear, acid urine. Moderate fever, pulse still very rapid. Very profuse discharge, requiring frequent change of dressings. June 28: Urine turbid, containing pus, no casts; general condition improved. July 1: Urine 25 ounces, very turbid, alkaline, containing pus, triple phosphates, many bacteria. Discharge from incised sac and from the rest of wound continued excessively copious, and, though fever was moderate, patient was failing. Only hope lay in getting rid of the ill-drained pus sac. August 3, nephrectomy. Chloroform. Massive tumor exposed. A number of good-sized calculi felt in the degenerated organ, which, on account of considerable dense adhesions, was developed with much difficulty. Bleeding moderate. Elastic mass ligature. Wound packed with gauze, its angle closed by button sutures. Patient bore operation very badly. Immediately after its completion temperature began to rise, reaching 104° by midnight. Excessive restlessness. August 4: No response to ordinary forms of stimulation; intravenous saline infusion. Vomited black material. Passed only 13 ounces of a very thick and turbid

urine since operation. Temperature 105.6°. Died at midnight. No autopsy.

Epicrisis.—It was an error not to have primarily removed the kidney.

CASE XL.—*Calculous pyonephrosis. Nephrotomy. Nephrectomy. Cure.* (*Hospital Reports*, 1903, p. 159.)

Sarah L., twenty-eight years old. Admitted October 17, 1900. Multipara. Three years ago had attack of renal colic with radiating pain to genitals and thigh; tenesmus; attack terminated with passage of two small stones. From that time on constant pain in right loin. No blood in urine, which was constantly turbid. Four weeks ago an unusually sharp attack accompanied by nausea, lasting a week. Had lost much flesh and strength. On admission: Normal internal organs; pulse and temperature normal. In right loin a large, tender tumor, its outlines readily seen, extending to median line, and downward to level of umbilicus; smooth, movable. October 8, cystoscopy. Moderately congested bladder, pus escaping from right ureter. Urine cloudy, acid, sediment consisting of pus, epithelial cells, and mucus; daily amount, 15 ounces; no casts; no tubercle bacilli. October 22, temperature rose to 101°. Passed 18 ounces of urine. Patient's general condition poor, strengthening regimen. November 16, nephrotomy. Oblique incision. Scanty layer of fat. Kidney exposed and delivered, was fluctuating. Incision along convex border evacuated large quantity of foul pus. Large stone crumbled away in the grip of forceps. By irrigation débris removed from pelvis of kidney. Hemorrhage considerable, patient's condition alarming. Kidney drained and replaced. Patient rallied from operation, quantity of urine increased, but had fever every evening. Pus continued in urine. December 21, subcapsular nephrectomy. Previous to operation preliminary intravenous infusion of 1000 cm. of saline solution. Chloroform. Kidney closely adherent to peritoneum, which was accidentally opened, but immediately closed by suture. A second peritoneal tear in delivering upper pole of kidney, which could not be closed by suture, protected by packing. Fibrous capsule of kidney intimately adherent to surrounding tissues. It was split along

convexity and parenchymatous portion readily enucleated. Elastic ligature. Wound packed with iodoform gauze brought out at upper angle; lower angle closed by button sutures. Specimen: Somewhat shrunken kidney, 4 x 2 x 1 inch; cortex and pyramids atrophic, yellow. Patient bore operation fairly well. December 26, temperature normal. General condition much improved. January 13, 1901, ligature came away. February 17, discharged cured, in very good condition. Urine free from pus.

CASE XLI.—*Calculous pyonephrosis. Insufficiency of opposite kidney. Nephrotomy. Improvement of insufficiency. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 173.)

Abraham L., age sixty-one, admitted October 15, 1903. Illness of three months' standing. Great frequency and pain in voiding cloudy urine. General condition very poor, fever to 103°, arteriosclerosis, emphysema of lungs, liver large, heart dilated. In left loin large tender, mass. Cystoscopy: Severe cystitis, preventing view of ureters. Urine: acid, 1010, albumin, pus. Urea 1.9 per cent. Total for 24 hours 138 grains. October 26, nephrotomy, removal of many calculi and evacuation of foul pus. Immediate improvement, quantity of excreted urea rising by November 18, to 438 grains, quantity of urine having doubled. Temperature which had fallen after operation rose again on November 29. December 4, nephrectomy. Specimen: parenchyma almost gone, still a number of stones in pelvis and calices. Cessation of fever, uninterrupted recovery. Discharged cured. January 18, 1904, urine still containing albumin and hyaline casts, but showing 411 grains of urea.

Note.—Was readmitted four months later in uræmic coma, to which he succumbed within two hours after admission. This case is accounted for in these statistics among those who died, though the operation has surely had nothing to do with the lethal ending.

CASE XLII.—*Calculous pyonephrosis of right side. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 99, ii, p. 631.)

Gertrude K., age forty, housewife. Admitted February 20, 1899. Seven months ago, first attack of renal colic. Nephrotomy done at Hartford, Connecticut, when stone was removed with much pus. Was operated on twice more, when more stones were extracted. On admission, a sinus was found leading down to a large tumor situated in right loin, which extended down-

ward to level of umbilicus. Left kidney not palpable. Urine, 42 ounces, acid, 1010, albumin, pus, urea 3 to 5 grains. Evening temperature about 102°, no night sweats. February 24, nephrectomy. Very difficult dissection on account of close adhesions of capsule to peritoneum and diaphragm. Pedicle tied outside of capsule by two elastic ligatures. Uneventful recovery. Ligature came away on twenty-second day. April 18, discharged cured.

CASE XLIII.—*Calculous pyonephrosis on right side. Nephrotomy extraction of stone impossible on account of hemorrhage. Nephrectomy. Cure.* (*Hospital Records*, 1898, i, p. 551; ii, p. 260.)

Pauline B., age twenty-five years, seamstress, Russian. Large painful tumor of right lumbar region, urine loaded with pus, fever. December 28, nephrotomy. Evacuation of pus (collapse), drainage. February 22, 1898, repeated efforts at extraction of stone abandoned on account of hemorrhage. April 23, discharged at request. Readmitted July 4. Sinus as before. July 11, nephrectomy. Difficult and bloody dissection. Elastic ligature. Saline infusion prevented collapse. August 11, discharged cured.

CASE XLIV.—*Calculous pyonephrosis of left side. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1898, ii, p. 81; ii, p. 749.)

Amelia Z., age twenty-eight, multipara. Admitted July 1, 1898. Had a vesical catarrh since three years, not improved by irrigations. December 27, 1897, paroxysmal attack of renal colic with high fever, urine purulent and very fetid, acute pain in left loin; appearance of large tumor. July 2, nephrotomy, evacuation of 800 Gm. of fetid pus and of a large, branching stone; drainage. July 14: Temperature normal, discharge formerly purulent, now serous (urine); tumor much reduced in size. Discharged with directions to return. October 23, readmitted. General health excellent. Discharge again purulent, temperature 98.6° F., left kidney still very palpable. Urine abundant, contains adequate urea and much pus. October 25, nephrectomy. Uneventful recovery. November 6, urine absolutely normal (no pus). Discharged cured.

CASE XLV.—*Calculous pyelonephritis of right side. Nephrotomy. Second nephrotomy and removal of pelvic calculus (both operations done at Birmingham, Ala.). Nephrectomy of con-*

tracted kidney. Cure. (Hospital Records, 1906-1907, vii, p. 848.)

Samuel M., age thirty-four, Russian, storekeeper. Admitted November 27, 1906. Five and a half years ago, severe pain in right loin, with vomiting, attacks recurring frequently. No radiation to bladder or testes. Six months later the appendix was removed at Birmingham. Two months afterward return of attacks. Three years ago nephrotomy, evacuating pus from kidney. Wound healed within two months. Renal colic continued in frequent attacks, hence six months after last operation renewed nephrotomy, when an irregular stone was removed from pelvis of kidney. Wound healed in four weeks. Since then recurrence of painful attacks with vomiting. Urine always cloudy. On admission, pulse and temperature normal. Emaciated, with suffering expression. In right loin oblique scar. No tumor felt, but deep pressure very painful. Cystoscopy: Mucosa swollen. Catheters entered both ureters easily. Urine of both sides loaded with pus, that of right side containing blood. Urea scanty in both urines. Evidently both kidneys were unsound. December 5, typical nephrectomy; on account of necessary haste, elastic ligature of pedicle. Kidney very small, irregularly contracted, deeply congested, contractions corresponding to massive cicatricial bands. Calices and pelvis dilated, cortex very thin. January 1, ligature came away. January 5, discharged cured.

Note.—Patient died of uræmia in January, 1911.

CASE XLVI.—*Calculous pyonephrosis of right side. Nephrotomy. Subcapsular nephrectomy. Cure. (Hospital Records, 1908-1909, vol. vii, p. 1105.)*

Lizzie K., age forty years, housewife, Russian, multipara. Admitted May 4, 1909. Five months ago dull aching pain began in right loin and had been constant. Lost weight. No hæmaturia or frequency of voiding. On admission, poorly nourished, temperature 100° F., pulse 136. In right flank a large, smooth, ovoid and tender mass, which is very movable. Urine, amber, clear, acid, 1018, a few pus-cells and coarse granular casts. Urea 1.7 per cent. Cystoscopy: Mucosa pale, trabeculated. Both ureters easily catheterized. Left kidney: Abundant clear urine. Right kidney: Absence of all secretion. Radiography, large irregular shadow in right loin. May 8, nephrotomy. Twelve ounces of thick pus evacuated. Drainage. Profuse dis-

charge continuous. May 31, temperature 104° F., remaining high until June 5, when nephrectomy was done. The organ was still very large. Capsule opened, kidney stripped, and large undrained abscess evacuated. A branching stone came away with pus. Easy delivery, elastic ligature. Specimen: No parenchyma; calyces distended by calcareous debris and pus. Uneventful recovery. Ligature came away on twenty-third day. Discharged cured July 7, 1909.

CASE XLVII.—*Ureteral calculi. Retroperitoneal exposure of right ureter. Nephrotomy. Passing of several stones. Acute hemorrhagic pyonephrosis. Nephrectomy. Secondary ureterectomy on ureter containing stone. Cure. (Hospital Records, 1907-1908, vii, p. 906.)*

Jennie F., age nineteen years, Russian, belt-maker. Admitted February 11, 1908. Since three months frequent renal colic of right side with vomiting and urgency of urination; between attacks constant dull pain in right loin, radiating to right thigh. On admission, kidneys not palpable, right rectus tense. Pulse and temperature normal. Urine, amber, acid, 1012, trace of albumin, no pus or blood. February 12: Radiograph shows shadow in right ureter 2½ inches above vesical inosculation. February 18, cystoscopy. Bladder and ureteral orifices normal, catheters passed easily into pelvis. Immediate rise of temperature (with chill) to 105°, urine containing blood and pus. Pain in right loin much increased. February 20, retroperitoneal exposure of right ureter by iliac incision. Ureter much dilated and thickened, but no stone could be felt. Exposure of right kidney by lumbar incision and delivery of organ. Nephrotomy and exploration of pelvis yielded also negative result. Drainage of pelvis, closure of both wounds. Fever continued with the old pain. February 23, passed *per urethram* about 10 fragments of crushed stone. Fall of temperature and diminution of pain. Did well until March 14, when there was a sudden rise of temperature to 106° with chill and sharp pain in right loin. Evidently an infection of the kidney had taken place, wherefore on March 15, nephrectomy was done. Kidney was found much enlarged, congested, and was the seat of a large number of hemorrhagic foci in various stages of purulent disintegration. Pelvis strongly congested. As radiograph still indicated the presence of a shadow in the lower ureter, the stump

of this organ was stitched to the skin and drained. Neither a ureteral catheter nor a metal instrument, nor palpation could reveal the presence of a stone. Elastic ligature came away on the twenty-fifth day, and the wound closed rapidly except where a tube passed into ureter. Further steps for the removal of the calculus were declined and she was discharged on April 17, 1908.

Readmitted February 14, 1909. After her discharge in April, she continued to suffer from attacks of pain along the ureter, and her urination remained frequent and painful. General condition was much improved. Wound in right loin had closed. Skiagraphy still positive. February 24, ureterectomy by long lumbo-inguinal incision. Organ much congested and dilated; in its lower end a very movable calculus of the shape and size of a date kernel. Interrupted recovery. Discharged cured, March 23.

SECONDARY NEPHRECTOMY FOR NON-CALCULOUS PYONEPHROSIS.

CASE XLVIII.—*Pyonephrosis of left side of old standing. Nephrotomy. Nephrectomy. Cure.* (*Hospital Reports*, 1899, p. 212.)

Jenny L., age twenty, admitted March 8, 1898. Never had been ill before. Eleven days ago began to have severe pain in left loin with chills and fever. In left loin hard, painful, rounded and movable mass, extending to level of umbilicus. Urine acid, 1023, albumin, no sugar, loaded with pus, 34 ounces in 24 hours. Temperature 103° F., pulse 100. March 14, nephrotomy. Kidney a pus sac, devoid of parenchyma. Drainage. Urine passed by urethra became clear and healthy. March 28: Tumor scarcely palpable. Easy nephrectomy, individual ligatures. Rapid recovery. Discharged cured June 27, 1898.

CASE XLIX.—*Large pyonephrotic kidney. Nephrectomy. Cure.* (*Hospital Reports*, 1899, p. 213.)

Tillie L., age thirty-five, admitted October 27, 1898. October 31, nephrotomy. Improvement of general condition. December 4, sent home to recuperate further. January, 1899, readmitted. Nephrectomy. Uneventful recovery.

CASE L.—*Ascending gonorrhæal pyonephrosis, perinephritic abscess. Nephrotomy. Drainage. Nephrectomy. Cure.* (*Hospital Reports*, 1899, pp. 213 and 214.) Typical case of no special interest.

CASE LI.—*Ascending gonorrhæal pyonephrosis. Nephrotomy. Improvement of general condition. Nephrectomy. Cure.* (*Hospital Reports*, 1901, p. 338.) Typical case without special interest.

CASE LII.—*Old pyonephrosis of left side. Acute suppression of urine of right kidney. Anuria. Double nephrotomy. Late secondary nephrectomy. Cure.* (*Hospital Reports*, 1903, p. 166.)

Clara S., age twenty-one, married, unipara. Six months ago began to have fever, which was declared to be malaria. Pregnant in third month. Three days ago developed severe pain in left loin; the following morning had severe chill with fever, a second chill the following night. During this last chill felt acute pain in right loin also. Frequent vomiting, great prostration. Had passed no urine since three days. Catheterization brought forth one ounce of thick pus only. On admission, March 5, 1901, pale, emaciated, anxious expression, exhaling urinous odor. Uterus the size of a fist. In left loin a large, painful mass. Pressure in right costovertebral angle also painful. Dry pleural friction sounds at both bases. Bladder empty. Immediate double nephrotomy and drainage. Left kidney exposed, was found distended by two pints of turbid urine. Incision and drainage. Right kidney was found contracted. Free incision opened a number of abscesses. Drainage. Chloroform anæsthesia, duration of operation one hour. March 6, aborted, curettage, intravenous infusion. Copious urinous discharge from both lumbar wounds. Temperature normal. March 11, return of fever. March 18, on account of continued fever nephrectomy of right side. Elastic ligature. Only traces of parenchyma left in specimen. March 19, passed 3 ounces of urine by urethra, then 5 ounces. April 7, ligature came off. Passed normally 39 ounces of urine. April 14, drainage withdrawn from left kidney. May 8, discharged cured, in excellent condition.

Note.—A desperate case, in which timely action was well rewarded.

CASE LIII.—*Nephrotomy done for pyonephrosis in another hospital. Far gone sepsis. Nephrectomy. Uræmia. Death.* (*Hospital Reports*, 1905, p. 174.)

John M., age forty-six. Admitted June 27, 1904. Five years ago an operation was done elsewhere, since when patient had been wearing a drainage tube. Frequent formation of abscesses

followed, which were either incised or had opened spontaneously. Extremely bad general condition. Urine acid, scanty, loaded with pus, 1010. July 1, nephrectomy. Kidney degenerated, a number of abscesses in cortex. Total quantity of urine passed from July 1, to July 4, 12 ounces, ending in total suppression and uræmia. Died July 4, in coma. No autopsy was permitted.

CASE LIV.—*Pyonephrosis of left side. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1898, ii, p. 198.)

Jennie L., age twenty, cap-maker, Russian. Admitted March 9, 1898. February 27, sudden pain in left side with chill, followed by frequent recurrence of pain, fever, and chills. Spleen enlarged, palpable; behind it another globular, movable, and painful mass, reaching down to level of umbilicus, not influenced by respiration. Pulse 130, respiration 36, temperature 103.4° F. Urine 1023, traces of albumin, no sugar, much pus and some blood. March 4, nephrotomy. One quart of fetid pus evacuated, no stone found; drainage. Immediate fall of temperature to 99°–101°. Profuse discharge from tubes. Patient's condition much improved. By June 28, tumor had so diminished that it could not be palpated; discharge still profuse. Very easy nephrectomy of a small, shrunken, cicatricial mass. Separate ligatures of vessels. Discharged cured July 27, 1898.

CASE LV.—*Ascending pyonephrosis of right side (old gonorrhæa; cystitis; strictures). Nephrotomy. Subcapsular nephrectomy. Cure.* (*Hospital Records*, 1898, i, p. 518.)

William B., age thirty, clerk. History of gonorrhœa, urethritis, stricture, and intense cystitis. Internal urethrotomy did not improve cystitis. Since two weeks intense pain in right side with frequent chills and high fever. Pain radiating to right testis. Large tumor in right hypochondrium. November 27, 1897, incision and drainage of large quantity of pus. Immediate fall of temperature to 99°, remaining at this level. Discharge diminishing *pari passu* with healing of wound and general condition improving steadily. December 24, cystoscopy. On massage pus expelled from right ureter. Urine becoming more purulent. Tumor still reaching two inches below costal border. Gained 15 pounds in weight. January 4, 1898, nephrectomy. Stripping kidney out of fibrous capsule; elastic ligature. Urine abundant. Interruption of healing by fever and retention after removal of packings. January 11, several abscesses opened. February 8, rubber came away. April 16, discharged cured.

CASE LVI.—*Fistula following nephrotomy. Nephrectomy. Cure.* (*Hospital Reports*, 1901, p. 197.)

Tillie L., age thirty-five. Admitted December 31, 1898, with renal fistula. January 3, 1899, nephrectomy. Kidney disorganized only traces of parenchyma remaining. Separate ligature of vessels. Discharged cured February 5, 1899.

CASE LVII.—*Ascending pyonephrosis of left side. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1900, ii, p. 565.)

Hermann T., age twenty-two, Russian, clerk. Admitted September 11, 1900. Four months ago gonorrhœa; on seventh day of this trouble dull pain in left loin. Temperature 103°–104° F. Pus in urine. Puncture of kidney in another hospital and nephrotomy; evacuation of much pus. Gained flesh after operation. On admission, in left loin scar and sinus discharging pus and urine. Moderate fever. September 13, cystoscopy. Pus escaping from left ureter. In left loin large tumor. September 27, typical nephrectomy. Kidney a large sac with traces of parenchyma and calcareous deposit in wall. Rubber ligature. Uneventful recovery. November 4, discharged cured.

CASE LVIII.—*Pyonephrosis of left side from multiple hemorrhagic infarcts. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1908–1909, vii, p. 1109.)

Annie C., age twenty-nine, Russian, silk-worker, single. Admitted May 9, 1909. Two weeks ago onset of frequent painful urination. One week later severe pain in left loin, aggravated by upright posture and walking. Chill, fever and vomiting. Appearance of urine unchanged. Had lost 18 pounds. On admission, temperature 103° F., pulse 100. Distinct pressure pain in left loin, where lower pole of kidney could be felt. Right kidney prolapsed, its centre being on level with umbilicus, not tender. Urine clear, amber, acid, 1020, pus, and a few red blood-cells and fine granular casts. Cystoscopy, bladder normal. Ureteral catheterism: Left side, pus-cells and red blood-cells, urea 1.1 per cent. Right side, many white, a few red blood-cells, a few hyaline casts, urea 1.8 per cent. Radiograph negative. May 13, nephrotomy. Three renal arteries were found, one of which, the size of a radial, was crossing and compressing the ureter. This vessel was divided between two ligatures. Kidney much enlarged and congested. Capsule being split, a number

of infarcts were found studding the cortex. One of these foci was excised. Pathological report: Hemorrhagic infarct in purulent disintegration. Subcapsular gauze drainage. Moderate fever. Anorexia and local pain continued, and as patient was evidently losing ground, an extracapsular nephrectomy was done on June 29. Rubber ligature. Specimen: kidney $4 \times 4 \times 2\frac{1}{2}$ inches. Pathological report: multiple purulent foci in cortex. Ligature came away on eighteenth day. Discharged cured, August 4, 1909.

CASE LIX.—*Miliary pyonephrosis of right kidney from septic infarcts. Nephrotomy. Continued sepsis. Nephrectomy. Suppression of urine. Death.* (*Hospital Record*, 1909-1910, x, p. 1478.)

Theresa H., age forty-five, housewife, Roumanian. Admitted March 30, 1910. Four days ago onset of sharp pain in right loin and hypochondrium, with fever and chills. Pain radiating to right shoulder. Urination neither frequent nor painful. On admission, temperature 104.3° , pulse 104. Great prostration. No jaundice. Marked distention of abdomen with rigidity of parietes in loin and right side. An indefinite, very painful mass can be felt in right hypochondrium. Urine cloudy, amber, acid, 1022, urea 1.2 per cent., loaded with pus, a few hyaline and granular casts. Immediate nephrotomy. Fatty capsule oedematous. Kidney much enlarged and congested, its situs almost transverse, color slaty bluish red. Fibrous capsule very tense. Aspiration yielded only dark blood. Incision of capsule, protrusion of parenchyma, which was brittle and showed many minute infarcts. Parenchyma was split, a drainage tube inserted into pelvis. Escape of large quantities of bloody serum. Kidney replaced and wound sutured. The fever subsided but temperature never reached the normal standard, patient's condition being that of a mild sepsis. April 19, rise of temperature to 104.4° F., pulse 130. Rigors and vomiting. April 25, temperature 105° , pulse 136, severe chill. Great pain in right loin, where a mass can be felt again. Nephrectomy. Elastic ligature. Specimen: Kidney four times the normal size, deeply congested. Cortex studded with innumerable miliary abscesses, many of which were wedge-shaped. Suppression of urine set in, which did not yield to the usual treatment. The temperature descended to the normal standard, but patient died of uræmia on May 5, 1910. No autopsy could be obtained.

Epicrisis.—Primary nephrectomy would probably have saved the patient.

CASE LX.—*Pyonephrosis of right side. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1898, ii, p. 889 and 899; i, p. 189.)

Tillie L., age thirty-five, United States. Admitted October 27, 1898. Married, three children. During last pregnancy, five years ago, began to have attacks of right renal colic with cystitis. Four months after delivery, cystoscopy. Was told that right kidney was diseased. Pause two years; then severe colic with chill and fever. Since then repeated attacks. Since one year noticed swelling and frequent painful urination. On admission, large, dense, deeply fluctuating mass in right lumbar region, extending inward to median line and downward to level of umbilicus. Urine 1014, acid, no sugar, much pus. October 31, nephrotomy. Drainage. Enormous amount of thick pus, no stone, little parenchyma left. Cessation of fever, improvement of general condition slow, hence discharged with directions to return. Readmitted December 31, 1898. Had gained flesh. January 3, 1899, nephrectomy. Scar incised, peritoneum exposed. Separate ligation of vessels. Tumor being comparatively small, development was easy, only a thin zone of cortex remained. Uneventful recovery. Discharged cured, February 5, 1899.

CASE LXI.—*Calculous pyonephrosis of right side. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1898, i, p. 551 and ii, p. 260.)

Pauline B., age twenty-five, Russian, seamstress. Admitted December 25, 1897. Severe abdominal pain since three weeks, radiating from loin, where under contracted musculature a tender tumor could be palpated. Repeated vomiting during paroxysms. Temperature 102.2° F., pulse 108, very weak, respiration 28. Urine amber, turbid, acid, 1022, loaded with pus. December 28, nephrotomy. Evacuation of a large quantity of pus. Finger introduced into pelvis could not detect a stone. Drainage. Continued profuse secretion of pus, with occasional exacerbations of fever. January 24, a calculus detected by probing. Attempted extraction by forceps abandoned on account of profuse hemorrhage and collapse. April 23, discharge diminished. Patient declining further operative measures, was discharged.

Readmitted July 4, 1898, with sinus still discharging. Though there was no fever, patient's general condition very poor. July 11, typical nephrectomy after a preceding saline infusion of 1000 grammes. Pulse remained good throughout. Separate ligature of vessels. Specimen: a degenerated kidney, practically a pus bag, containing several calculi. Uninterrupted recovery. Discharged cured, August 11, 1898.

CASE LXII.—*Acute pyelonephritis of right side, due to infection from an adherent diseased appendix. Nephrotomy. Temporary relief. Recurrence of local and general trouble. Nephrectomy and removal of adherent appendix. Cure.* (*Hospital Record*, 1905-1906, vii, p. 695.)

Valeria L., age eighteen, Pole, domestic. Admitted June 7, 1905. Six weeks ago was seized with sharp sticking pain in right loin, radiating toward sternum. Was confined four days. Urination normal. Yesterday sharp, exquisite pain in right hypochondrium, radiating to left shoulder. Chill. Vomiting bile continuously until quieted by a morphine injection. Urination normal, not bloody. On admission, young, strong girl of good color, in great shock; intense pain in right loin and hypochondrium. Pulse 60-65, temperature 99°. Dimensions of liver normal. Deep bimanual pressure of parts between loin and hypochondrium extremely painful. Neither gall-bladder nor kidney felt; no icterus. Muscles very rigid. No tenderness over McBurney's point. Urine 1030, acid, red blood-cells. June 8, exploratory incision revealed normal gall-bladder; palpation showed right kidney enlarged and fixed by dense adhesions. Closure of incision; a second incision made over right kidney, which being delivered was found enlarged, hard, and lobulated. Bloody, turbid serum withdrawn by puncture from pelvis. Opening of pelvis through parenchyma; no stone. Ureteral catheter passed readily into bladder. Tube drainage. The sinus contracted slowly, but was occasionally leaking. As there still was pain in the loin, which we thought to be due to the manifest pyelitis, systematic irrigation of the pelvis of the kidney was practised by ureteral catheter without much benefit. Attacks of sharp pain recurred from time to time, which could not be explained by the condition of the kidney alone. Therefore on October 21, another exploration was made through the loin. The peritoneal reflection being exposed, a cylindrical body,

the size of an index-finger, was found closely adherent to the anterior aspect of the pelvis of the kidney. This was found to be a diseased appendix. It was removed. As the kidney itself was much damaged, it was decided to remove it also, which was done. An uneventful recovery followed, and patient was discharged cured on December 20, freed from the pain she had so long felt in the loin.

Epicrisis.—This puzzling case is instructive on account of the difficulties of the diagnosis, caused by the atypical situs of the appendix. We had to deal with a colon which had not finished its wandering to the right iliac fossa during embryonal life. The cæcum was situated where would be normally the hepatic flexure, and an ascending colon did not exist. An ulcerative appendicitis had caused adhesion of the appendix to the parietal peritoneum, where it was in contact with the pelvis of the right kidney. By osmosis an infection of the pelvis of the kidney had taken place, maintaining a condition, the factors of which were both a chronic ulcerating appendicitis and a pyelitis. A careful search for the cæcum and appendix at the first exploration would have probably resulted in a clear understanding of the situation, in the removal of the diseased appendix and the saving of the kidney.

Deaths after secondary nephrectomy for calculous disease: (1) surgical kidney of opposite side; (2) chronic septicæmia from fecal infection; (3) recent uræmia; (4) late uræmia.

Deaths after secondary nephrectomy for non-calculous disease: (1) recent uræmia; (2) recent uræmia,

(*To be continued*)

THE END RESULTS IN SIXTY-THREE CASES OF OPERATION FOR BRAIN TUMOR.*

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THIS short paper will give the final results of 63 operations for tumor of the brain which have come under my personal observation during the past 25 years.

For 15 of these years, starting in 1887, it was my good fortune to be Dr. W. W. Keen's chief assistant, and as such I assisted him in operating upon the first tumor of the brain which was successfully removed in America.

The results given here are from the records of those cases of his in which I assisted in the operation and after-care, and of those upon whom I have operated myself. I am greatly indebted to him for this opportunity of giving the results in his cases. It will therefore be seen that this is essentially a personal experience, and no attempt has been made to collect the results of other operators.

A statistical record of the results in operations for tumor of the brain by many surgeons would be too great a task, and the resulting table would be, to say the least, of very doubtful value.

Methods of operating, the judgment when to go ahead and when to keep hands off, whether to stop and be content with simple decompression or to plunge into the tissues of the brain and try to find a deep-seated growth, are all great factors in the final results, and must be taken into account when the work of a large number of surgeons is considered. It is a sad fact, but one which must be faced, that there seem to be some operators who give results which others cannot possibly obtain, and who report their successes so soon after the date of operation that little real dependence can be placed upon their findings.

* Read before the American Surgical Association, May 31, 1912.

We all know how many cases there are of tumor of the brain which cannot be localized with any degree of accuracy, and when the skull is opened cannot be found. Then there are a certain, but smaller, percentage of cases where at operation the tumor is found but cannot possibly be removed. And then there are a very small number of cases where the tumor can be readily located, and completely or partially removed.

It is in this small number of cases, and it is very small indeed, that brilliant results are obtained. Most of these are small tumors, many of them arising from the dura, clearly limited in outline. They may be in the brain or only involve the brain by mechanical pressure owing to their size and location. Of this type was the first brain tumor removed by Dr. Keen in December, 1887. It was a simple fibroma of the dura, benign in character, of very slow growth, and absolutely free from any attachment to the brain itself. This patient lived for nearly 20 years, much improved in many of his symptoms, but practically blind as the result of the long-standing intracranial pressure. There have been only two others among all of our cases who have lived for six years, and only one of these is living to-day. All the others have died within three years of operation. There have been tumors where the primary surgical results have been most satisfactory, but most of these, endotheliomata and gliomata, have quickly recurred and resulted in death within a comparatively short space of time.

The value of decompression in relieving the distress incident to the increased intracranial pressure is now so well established and the operation so universally practised that little need be said here in its favor. One of my own cases, rapidly becoming blind, with headache and vomiting, whose skull was opened first on one side and then on the other, in the temporal region, has been able to take up his work of a gardener and has supported himself for over two years. It relieves the intense headache and papilla oedema, thus preserving the eyesight, and, if undertaken sufficiently early, undoubtedly materially prolongs life. Many of our earlier operations for tumor of the brain were too radical, the search for the tumor was too pro-

longed, and great damage was done in consequence to the convolutions and centres. Many of these cases were in desperate straits, were in reality past the point where they could have been benefited. To-day these same cases would have come to operation earlier and with much better chances of relief. I believe now, with increased experience, that unless the location of the tumor is very evident, the tissues of the brain should not be damaged in an effort to find it, and that reliance should be placed upon decompression to relieve the symptoms. In several instances decompression and thus relief of high pressure has permitted the tumor to push its way to the surface of the brain, and at a second operation be removed.

We have had six tumors of the dura. Of these, three died within a few hours from hemorrhage, and three survived operation. One of these was our first, who lived for nearly 20 years. The second, after making a brilliant surgical recovery, died of a recurrence of the disease, an endothelioma, 108 days after operation. The third recovered from the operation and was reported five months afterward as improved, but it has been impossible to learn her subsequent history. Dural tumors are particularly prone to bleed, and this is due of course to the nature of the growth, which is almost always an endothelioma. All the vessels are engorged, the smaller ones dilated, and the bleeding general over the dural surface. It is extremely difficult to control this general bleeding; ligatures are of little use, and at times it may be necessary to perform the operation in two stages. Venous bleeding is much more fatal than arterial, and I have seen several patients die from the loss of an amount of venous blood which did not appear very great.

There were in all eight simple cysts of the brain substance—four of these were cerebral and four cerebellar. Six of these recovered from the operation of simple drainage, and one at least has lived comfortably for five and a half years, and is living to-day. It was necessary however to drain this cyst a second time. There were in addition to these simple cysts, and by this I mean cysts which had such thin walls that no attempt at removal could be undertaken and drainage had to suffice, three cases of cystic degeneration of a distinct new growth.

One was a broken-down gumma; a second, cystic degeneration of a sarcoma of the cerebellum; and the third, a cyst with thick walls which was dissected out completely. This was believed to have undergone sarcomatous degeneration, but the patient lived for six years in apparently good health. Finally there was a recurrence and death followed a second operation.

The total number of cases was 63. In 33 the tumor could not be found at operation, and a decompression gave more or less relief to the patient.

In 30 cases the tumor was found and removed at operation. In 14 of these the new growth was completely gotten away. In 9 the growth was only removed in part, owing to its infiltrating character. In 8, cysts were found and drained.

The operative mortality is very high, much higher in fact than I had supposed until these histories were studied with care: six patients died within the first five days, four of these within 24 hours, when the skull had been opened and no tumor found. One of these died of pneumonia in five days, and one of œdema of the lungs in 17 hours. Thirteen died within ten days of the operation, of those in which a tumor was found and removed; eight of these died within 36 hours, and one from chloroform.

One case of cerebellar cyst died in five days, as a direct result of operation.

Nineteen deaths, all told, as a direct result of operation, that is within ten days, in 63 cases is a very high percentage of mortality (30 per cent.).

The final or end results in all of these 63 cases are very bad indeed.

One case of cyst of the cerebellum is alive and well at this time, five and a half years from the date of the first operation and three years from the date of the second operation of draining the cyst.

One case of glioma of the brain is living and comparatively comfortable, three years since the first operation and eighteen months since the second operation. This patient has a recurrence of his growth and must soon go.

There are three others now living, but three years have not yet passed since they were operated upon.

In our earlier work the value of decompression as a life-prolonging measure was not fully recognized and was not urged upon our patients as it would be to-day. Many cases of tumors of the brain which could not be localized with reasonable certainty were therefore allowed to suffer the violent headache, vomiting, and loss of sight which we now know could be relieved.

It seems to me the time has come to give a plain statement of facts in regard to the end results, and by one who has had an experience now covering a period practically of 25 years. I do not know what the statistics of other operators may show in the way of end results, but I doubt, if the truth be told, if their experience, covering the same number of years, would offer much more encouragement. Occasionally the results are so brilliant and often so unexpected that these poor unfortunates should be given the chance of relief which operation alone affords. The possibility of several years of life made comfortable and in some instances of great usefulness may well be striven for, and the dangers of operation, while very great, are not to be compared to the benefits which may be obtained.

The operation of decompression as now practised is one of such simplicity and safety and in the want of accurate localization should always be advised. Many and in fact almost all of our earlier cases submitted to operation when the tumor could not be found should not be considered as simple decompressions. As I have stated, we then believed in searching the brain for the growth, and thereby inflicted so much damage to the tissues that the mortality rate was very high. In the past few years every case but one of simple decompression for pressure has made a good surgical recovery. This one, a cerebellar growth, was decompressed in the temporal region when it should have been over the cerebellum. The error was I think pardonable, as the autopsy showed acute dilatation of the lateral ventricles, producing great pressure and total palsy of every nerve passing through the great sphenoidal fissure.

**BULLET WOUND OF THE SPINAL CORD BETWEEN
THE FIRST AND SECOND DORSAL VERTEBRÆ;
LAMINECTOMY; REMOVAL OF THE BULLET;
COMPLETE RECOVERY.***

BY WILLIAM B. COLEY, M.D.,

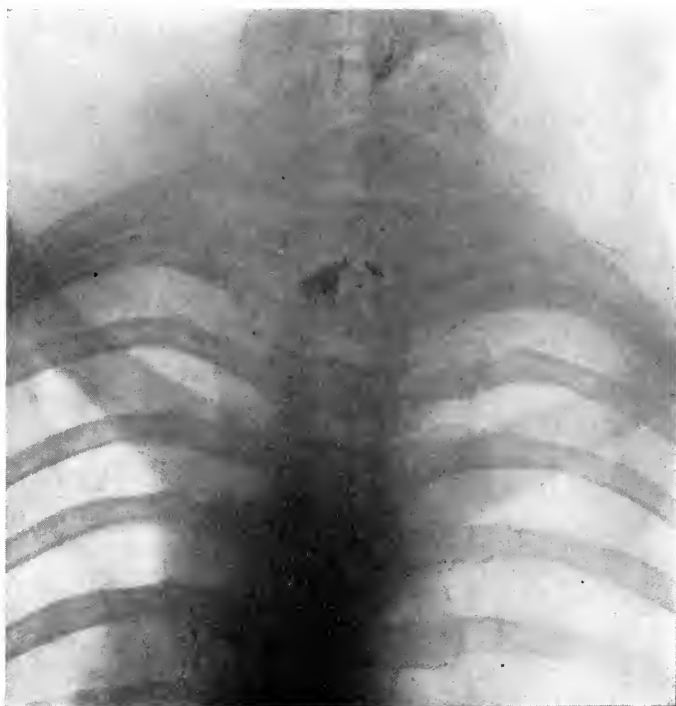
OF NEW YORK,

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General Memorial Hospital for the Treatment of Cancer and Allied Disease;
Attending Surgeon to the Hospital for Ruptured and Crippled.

E. H., female, age fourteen years; in perfect health until July 18, 1911, when, while riding in an automobile, at Wilton, Connecticut, she was shot in the back. A bullet from a .22 calibre rifle shot at a distance of 10 to 15 yards entered the spine between the first and second dorsal vertebræ, almost in exact line with the spinous processes and travelling in a direction nearly at right angles to the plane of the back. The girl immediately lost complete control of the lower extremities, and partial control of the upper extremities, and both bladder and rectum sphincters, and suffered very severe pain. She was taken in the automobile to the home of her uncle, Dr. Warren Hitchcock, of Norwalk, Conn., about four miles distant. The latter states that there was immediate and complete loss of power in the left leg and nearly complete in the right. She could move the fingers and forearm slightly but not the upper arm. There was considerable hemorrhage at the time but not much after her arrival at the house. Pain was severe and continuous and required a hypodermic of one-fourth grain of morphine every six hours to relieve it. Patient described the pain as being "all over." The loss of power increased in the right leg and involved the arms, especially the right. She also complained of difficulty of breathing and of pain in the chest. There was complete loss of power of urination and no movement of bowel without enema. I saw her about 24 hours after the accident, at which time she was apparently suffering severe pain in spite of considerable doses of morphine.

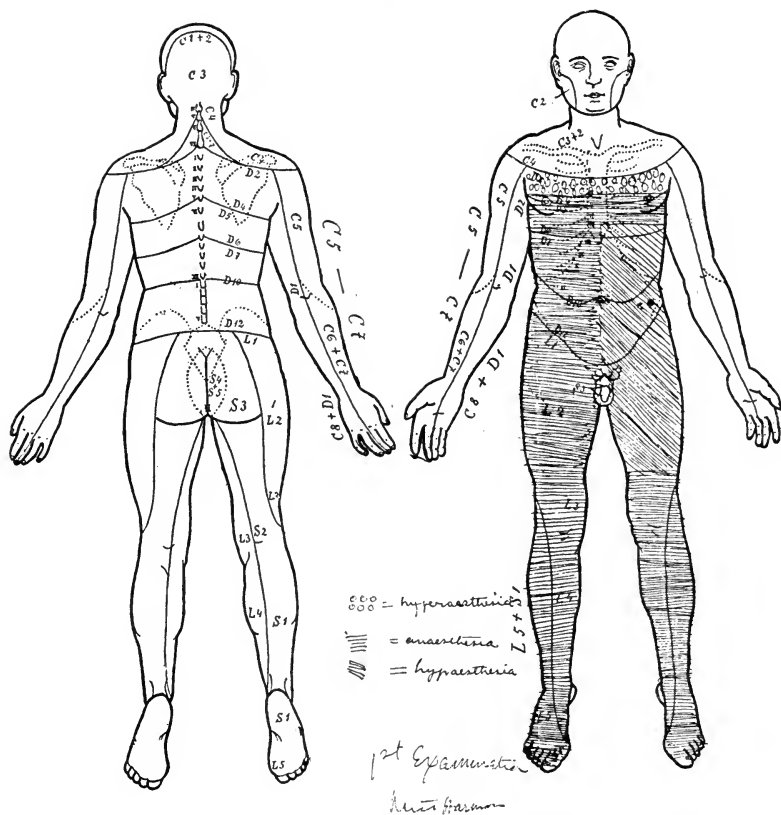
* Read before the American Surgical Association, May 29, 1912.

FIG. 1.



Skiagraph showing presence of bullet lodged in spinal cord.

FIG. 2.



Diagrams showing changes in nerve sensibility four days after wound of spinal cord.

Examination showed a small wound, apparently the entrance of a bullet, in almost exactly the median line of the back opposite the second dorsal vertebra; hyperæsthesia general but especially marked below the level of the second dorsal vertebra.

I advised that an X-ray be taken as soon as possible, and the next day Dr. L. V. Cole, of New York, saw her and took several photographs. His report reads as follows: "Contour and structure of the spine and ribs show distinctly. The bullet and several fragments show distinctly and are lodged between the first and second dorsal vertebrae. There are two large fragments and several small ones. The large fragment lies just to the left of the median line, and the larger of the smaller fragments lies just to the right of the median line. Viewed stereoscopically, the one to the left appears to be a trifle deeper than the one to the right. I find no evidence of the bullet's having fractured the vertebrae, and it appears to have lodged between the laminae rather than to have perforated one of them. Diagnosis: From a study of these plates one is justified in stating that the bullet is in the position described in the findings and that it has entered the spinal column between the laminae rather than through one of them. Whether the bullet has perforated the cord or merely lies against it causing the pressure, I am unwilling to state with certainty, but I believe that there is sufficient doubt of this having severed the cord to justify one in removing it."

I decided to operate as soon as possible, and on July 22, the fourth day after the accident, the patient was brought to New York by train and ambulance. She arrived at the General Memorial Hospital at about 11 o'clock and the operation was performed an hour later, following a careful neurological examination by Dr. E. G. Zabriskie, of the Neurological Institute, whose report reads:

First examination, one hour before operation: "Well-nourished young girl of medium build. Head, neck, and face normal. Mobility of both arms good, although active and passive movements of right arm cause intense pain. Paralysis of both sphincters. Both legs completely paralyzed. Knee-jerks active; ankle-jerks active; pseudoclonus, left side. Babinski present on left side; right side doubtful. Reflexes of both arms present. Abdominal reflexes absent. Pupils equal, respond promptly to light and accommodation. Sensory disturbances (see chart). At the

level of the fourth rib there is a zone three inches wide, in which all sensation is abolished; above this there is a zone of hyperæsthesia which shades off into normal sensibility. Below the zone of anæsthesia the right half of the trunk and right leg show a complete loss of pain and temperature sense, and loss of perception of light touch; heavy touch, *i.e.*, pressure, is perceived and if deep enough causes pain. The left half of the trunk shows hyperæsthesia, hypalgesia, and thermohyperæsthesia, as far down as the middle of the left thigh. From this point downward cutaneous sensation is completely abolished. There is complete inability to localize cutaneous stimuli anywhere below the fourth rib. Deep muscular sense lost on left side; partially preserved on right side."

Two hours after admission I performed the operation with the assistance of my associate, Dr. Wm. A. Downes, and the house staff. A longitudinal incision, 3 inches in length was made in the median line over the spinous processes, on a level with the second dorsal vertebra. A small, ragged wound was found and traced inward. The spinous processes of the first and second dorsal vertebræ were removed with Rongeur forceps and chisel, and an opening made in the lamina, about $1\frac{1}{2}$ inches in length; exposure of the dura, showed a ragged hole about $\frac{3}{8}$ inch in diameter. The bullet had perforated one of the laminae. This opening was enlarged by a vertical incision, and the cord exposed. There was considerable flow of cerebro-spinal fluid. Following the track of the wound into the cord itself, the two fragments of the bullet, as shown by the X-ray, after some searching were found embedded in the substance of the cord, about $\frac{1}{2}$ inch from the surface. No attempt was made to suture the dura. A small cigarette drain was passed in the wound extending to the dura and the skin wound carefully closed, except that sufficient opening was allowed for drainage. The patient was put upon a water-bed and given sufficient morphine to control the pain. Very free discharge of cerebro-spinal fluid continued for ten days and then gradually began to diminish. At no time was there any suppuration. The patient was kept on a water-bed for about six weeks. The excruciating pain gradually lessened. After three days there was marked improvement in her ability to move her arms and hands and within a week she was able to use one foot a little. The improvement was gradual, but continuous and at the end of two months she had regained considerable power in

the muscles of the lower extremities. She sat up for the first time on September 2d, started to walk on crutches in the latter part of October, and returned home November 1st. By the 20th of November she was able to walk without support. A photograph taken December 6, 1911, shows her out in the yard throwing snow-balls, with almost complete restoration of power. She is at present perfectly well, has only a slight limp in her left leg, can play piano, and do nearly anything she ever could, but run fast.

A case closely resembling my own, is that of Pilcher's, published in the *ANNALS OF SURGERY*, vol. xxxviii, p. 812, 1901, although in this case the bullet was not imbedded within cord, and it is not certain that it penetrated the canal. The patient was a boy 11 years of age who was shot with a .22 calibre rifle bullet, entering just below the episternal notch, ranging upward and backward and apparently passing through the spine between the fifth and sixth cervical vertebræ. The boy was paralyzed below the clavicles, both as regards motion and sensation; he had priapism, involuntary urination and defecation. He gradually improved, regained control of the bladder and bowels and began to have voluntary movements in his limbs. At the end of a month, laminectomy was performed, but no injury of the cord was detected. Later he regained considerable muscular control as well as sensation. An X-ray taken a year after the injury showed the bullet embedded in the spinous process of the sixth vertebra.

Winslow in reviewing the case states that he is not convinced that this was not a case of concussion, rather than a perforation of the cord.

Winslow's (*Trans. South. Surg. and Gyn. Ass'n*, vol. xxiii, p. 432) case of complete transverse destruction of the spinal cord from pistol wound, without penetration of the spinal canal, is one of extraordinary interest. The patient, male, white, 24 years of age was shot with a pistol in the left side, the bullet entering between the seventh and eighth ribs, just posterior to the midaxillary line. The patient fell immediately to the ground and was paralyzed from near the umbilicus downward, both as regards sensation and motion. The patient was promptly taken to the hospital, where examination showed complete muscular and sensory paralysis below a line extending around the body $1\frac{1}{2}$ inches below the umbilicus in the median line in front and curving upward and backward along the upper border of the twelfth rib to the spine. Three days later laminectomy was performed by Dr. Winslow, the laminae of the seventh, eighth, ninth and tenth dorsal vertebræ being removed. There was no blood in the canal and the dura was uninjured; the bullet was not discovered. The cord was not severed, nor did it appear to be altered, but subsequently some grumous material escaped from the cord. The patient was not improved, nor was he apparently made worse by the operation. The wound healed per primam. The patient became emaciated and later developed bed-sores, but was still living at the time of the report.

Winslow reported a second case of pistol shot wound from a .32 calibre bullet which entered the second dorsal vertebra, in a woman aged eighteen years. The victim fell forward with paraplegia, paralysis of the left arm, dilatation of the left pupil and alteration of the pulse. Later there was partial restoration of sensation and motion to the left arm. Complete anæsthesia extended to the first rib on the left, to the third on the right. Clinical diagnosis: Pistol shot wound of the second dorsal vertebra, crushing or otherwise injuring the spinal cord. No operation; death on the twenty-first day following the injury. Autopsy by Professor Michael: The bullet cut the posterior margin of the left sternocleidomastoid muscle, then passed behind the brachial plexus, cutting a small nerve, then passed between the anterior and middle scaleni muscles, broke the tip of the transverse process of the seventh cervical vertebra, penetrated the body of the second vertebra and impinged on but did not penetrate the spinal canal. There was some bloody serum in the canal and spinal meningitis was present. The cord was not penetrated or compressed, but was disintegrated, and much reduced in size opposite the location of the bullet.

These two cases show that very serious lesions may result from bullet wounds of the spine without penetrating the cord. Winslow believes the injuries due to concussion, though he finds it difficult to understand how a complete transverse destruction of the cord can occur without a direct impact.

A wide divergence of opinion apparently still exists as to the proper method of treatment for bullet wounds of the cord.

Winslow, after a report of his cases and a review of other cases of bullet injury to the cord, concludes:

1. That serious and even fatal lesions of the spinal cord may be produced by concussion, without direct impact.

2. That in gunshot injuries, with a probability of complete severance of the cord, laminectomy should be performed, foreign bodies and clots removed, bleeding arrested, and if the cord has been divided, the separate ends should be approximated with sutures.

3. Care should be exercised not to destroy any nervous fibres or tracts that may still be intact.

In the discussion of Dr. Winslow's case, at the meeting of the Southern Surg. Assn. in 1911, Dr. Thompson, of Galveston, laid great emphasis on the physiological fact that the spinal cord is incapable of regeneration. He stated that the

indications for operation can thus be reduced to absolute simplicity. Any injury attended by the immediate onset of paralysis and anæsthesia has probably destroyed the conductivity of the cord, and if there is no displacement of the vertebræ or pressure on the cord by spicules of bone or anything like a bullet or blood clot pressing on the cord, operation can hold out no hope of improving the condition of the portion of cord actually injured. He asks "What possible good can we expect from mere exposure of the cord? Are we not more likely to do harm by the extra risk of sepsis?" He further states, "I have removed bullets from the pedicles of the vertebræ in two cases where the primary symptoms at the time of injury were those of a complete transverse lesion. Later on, motion and sensation were restored in part, but both patients showed evidence of descending degeneration in the lateral columns. I never expected to cure the patients by the operation, because I knew that the mere removal of the bullet could not arrest the degeneration or favor regeneration."

A case reported by Dr. Fort, of Nashville, in connection with the discussion of Dr. Winslow's paper, supplies evidence directly contrary to the opinion held by Thompson and others, that operation can do little good. Dr. Fort's patient was a young man of twenty-five years who was shot in the back with a 32-calibre revolver, the bullet entering the abdomen, fracturing the eighth dorsal spinous process. Laminectomy was done 23 hours after the injury. On opening the dura a spiculum of the transverse process was found penetrating the cord near the bullet or a portion of the bullet. In this case there was complete paralysis from the beginning, both motor and sensory, with priapism, retention of urine and incontinence of fæces. The dura was closed with No. 1 sterile, plain catgut. The patient made a perfect recovery and was leading the active life of a railroad contractor at the time of the report, four years later.

This case, equally with my own, shows the great importance of early operation in bullet wounds of the spine involving injury to the cord.

In the "System of Practical Surgery" (v. Bergmann, vol. ii), it is stated that "recent injuries of the spine do not demand surgical interference any more than stab-wounds of the cord. If the surgeon follow the rules laid down by modern military surgery, he will leave the wound alone and protect it from secondary infection by using an antiseptic dressing. Even when nervous elements are injured, he will be inclined to adhere to this form of treatment. Gun-shot wounds of the cord demand interference just as little as crushes and stab-wounds. The operation serves only the purpose of removing the compression produced by fragments or the projectile. In gun-shot wounds a differential diagnosis cannot be made for several days or weeks, so that one should generally wait for a time before interfering. An early operation is indicated only in cases in which the cord symptoms indicate pressure due to fragments or from the projectile. It remains to be decided whether in these cases it is not best to wait until the skin-wound has healed, so as to be able to operate with a greater chance of preserving asepsis."

Prewitt ("Gun-Shot Wounds of the Spine," *ANNALS OF SURGERY*, 1898) whose experience was based upon cases seen in the Spanish War, believes in operating when the region is accessible and the condition of the patient justifies operation. Of 58 cases of wounds of the spine seen by him, 33 ended fatally; and of 25 which were operated upon, 12 recovered.

Schmidt in 1902 (*Schussverletzungen der Wirbelsäule in Deutsche Milit. Zeitschr.*, 1904) at a meeting of surgeons in Berlin, spoke in support of early operation. He stated that German government statistics show that of those operated upon for injuries of the spine, 62.5 per cent. lived, while of those who were not operated upon, only 24 per cent. recovered.

Carson, of St. Louis, states that the treatment as laid down by modern military surgeons is to leave the wound alone, only protecting it from infection from the outside. This applies to gun-shot wounds as well as stab-wounds. After the sensory localizing symptoms have appeared, and when a radiograph shows that the bullet or a splinter of bone is causing compression of the cord, then operation for the relief of such pressure is indicated. The question of waiting until the wound caused by the projectile or weapon has healed, is one that must be settled in each individual case. If fitting treatment can be employed, it is perhaps better to wait, as thus the danger of infection is made less. However, it must be remembered that pressure upon the spinal cord or its membranes, when continued for long, is apt to result in local destruction of the cord.

Krajewski (*Jahresbericht über die Leistungen und Fortschritte aus d. Gebiete der Neurologie und Psychiatrie*, vol. x, 1906) after a careful search of the literature, found 32 cases of laminectomy with or without removal of the bullet, with 24 deaths. Actual improvement as a result of the operation occurred only in one instance, the case of Preusth, *ANNALS OF SURG.*, 1898, vol. xxviii.

Krajewski points out the dangers of the operation itself and refers to one case in which the patient lived for five years after the injury and

then died six days after operation. Of 22 cases treated conservatively, 16 died.

Krajewski believes that operation should be resorted to only if it can be done immediately after or on the day following the injury. It does not serve the purpose of preventing paraplegia, but may obviate an infection and favor circulation at the site of injury. In the later stages operation is indicated only if new symptoms develop as a result of the inflammation.

Woolsey (Keen's Surgery, vol. ii) in dealing with the subject of gunshot wounds of the spine, states: "If the bullet is in or very close to the canal, or if the bullet tract is likely to be or become septic, it is best to operate early. If the skiagraph shows fragments or splinters of bone in a position to press upon the cord, they should be removed by early operation. If infection occurs, operation is indicated; otherwise nothing is to be gained by operation, as the damage to the cord is done."

Thus it will be seen that most of our modern authorities on the subject either advise against early operation or advise it in a very cautious and conditional way.

This is not the time, nor do I feel myself competent to discuss the vexed and complicated question of the possibility of the spinal cord's recovering its function after actual destruction of its axis cylinders. The clinical evidence thus far is insufficient to settle this question and in my opinion it can be settled only by careful experimental work. Such experimental work has already been begun by Alfred Reginald Allen, of Philadelphia (*Jour. Am. Med. Assn.*, Sept. 9, 1911, pp. 878-80). This preliminary work gives us important new data bearing upon this subject, and his further experiments, already outlined, are full of promise. He has succeeded in determining the amount of impact the spinal cord in an animal can receive and yet recover its function. He has further shown that a median longitudinal incision into a spinal cord is provocative of no symptoms of note. In five dogs whose spinal cord had been subjected to a hyperimpact of 540 gram-centimetres, a median longitudinal incision from 1 to 1.5 cm. long, was made directly through the impact level and passing altogether through the spinal cord. These dogs made uneventful recoveries and yet this impact was sufficient to have led to dire consequences, had not the median longitudinal incision been made. His control experiments showed that the dogs would

have died, had not the spinal cord been drained. His tentative conclusion is:

"That in cases of fracture dislocation of the spinal column in the human subject, in which there exists the symptom picture of transverse lesion of the spinal cord, it were well to perform the operation of laminectomy at the earliest possible moment, and if the cord be not completely severed, to make a median longitudinal incision through the area of impact by means of a fine canaliculus knife in order to drain the injured tissue of the products of œdema and hemorrhage."

I believe the dangers of laminectomy, which have been so strongly emphasized by Thompson and others, to have been greatly exaggerated. Bailey and Elsberg (*Jour. of the Am. Med. Assn.*, March 9, 1912, pp. 675-79) in their recent report state that while "laminectomy must always be classed as a major operation, much of the gravity associated with it is due to the life-threatening conditions for which it is undertaken. Except for section of the posterior roots for spasticity and pain, the laminæ are removed by the surgeon only for conditions of the most serious character, most of them direct menaces to life. The burden of mortality, therefore, which appears in any statistics of laminectomies should be borne by the disorders for which the operations were undertaken, rather than by the operations themselves. If the cases of spinal cord disease or injury in which the surgeon attempts to remedy the irremediable or to operate on patients almost moribund, are left out of account, it will be found that laminectomy in experienced hands is neither a particularly hazardous nor a trying operation. In our experience, if the five cases just cited—all hopeless from the onset—were excluded, we would have done twenty-nine primary laminectomies without fatality, so that we have come to look on laminectomy in a patient in good condition as a fairly safe operation." I further agree with Bailey and Elsberg in their conclusion that "Even in the absence of increased intradural pressure or a discoverable lesion, the operation of laminectomy and incision of the dura may be of great benefit."

"For the reasons above stated and on account of its relative safety in experienced hands, exploratory operation should be done more often."

In my own case I believe it fair to state that the patient's life was probably saved by the operation. Certainly her ability to enjoy life is due to early operative interference.

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THE TREATMENT OF THE DEFECT OCCASIONED BY PARTIAL EXCISION OF THE IN- FERIOR MAXILLA.*

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OF SAN FRANCISCO.

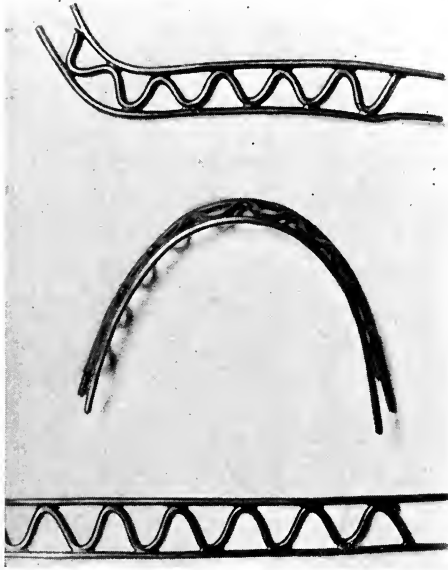
A LONG and on the whole a bitter and disappointing experience in the operative treatment of epithelioma of the buccal mucous membrane and lips, in which, by extension or by metastasis, the inferior maxilla or its periosteum had become involved, tempts me to give some personal experience with these cases, rather with a hope that it may awaken some discussion than with the idea of advancing anything new in operative technic. In a prefatory way I may say that at least on the Pacific Coast the surgery of the mouth, lips, and neck is very much inferior to that of any other part of the body. Much has been published, both in journals and text-books, as to the necessity of thorough and complete dissection of the mental, submaxillary, and cervical glands in cancer of the lip and mouth. Nevertheless the surgeon is too often content to confine his work to the lip or mouth alone; the dermatologists still continue to use the X-ray and to discuss the relative merits of various escharotics, with or without the use of the curette, giving no thought apparently to the question of metastases; and the general practitioner does not seem to view with the same concern cancer of the lip or buccal cavity that he does cancer of the breast or cervix. The fear of mutilation by the knife together with the alluring prospects held out by the cancer sharps that infest every city are also potent factors in many cases. The result is a large number of cases of cancer extending to and involving the lower jaw, or cancerous glands attached to its periosteum, the primary growth healed or not as the case may be. The fear of deformity and mutilation

* Read before the American Surgical Association, May 30, 1912.

following removal of a portion of the jaw in these cases often leads to incomplete work, for in many cases it is only by such removal early that the growth can be widely enough excised. Cancer of the lip and cancer of the buccal mucous membrane are not within the scope of this paper, but were these affections properly treated in the outset, there would be little call for a discussion of the subject; for with the exception of epithelioma originating in the alveolar process, and primary sarcoma, there are practically few conditions that call for excision of portions of the mandible together with its periosteum, except growths resulting from metastases in the sublingual or submaxillary glands, or from direct extension of an epithelioma of the mouth. Since the fear of deformity resulting from loss of symmetry in the two halves of the mandible, and of disturbance in the relation of the teeth resulting therefrom, are the factors chiefly responsible for the hesitation to do a properly radical piece of work, I hope to show that such deformity can be prevented to a large extent in most cases, and in some, almost entirely. In order to prevent deformity, it is necessary that the defect occasioned by the removal of a portion of the jaw be filled in by some material; and the only material that will do the work permanently in my experience is bone. The conditions, however, are not favorable for transplantation of bone immediately, and if some means are not taken to prevent cicatricial contraction during the healing of the wounds, the deformity will already have occurred and cannot subsequently be overcome. For a number of years I used heavy silver wire as large as telegraph wire to keep the cut surfaces of bone separated the proper distance; later, I used silver plates and recently have been using a light truss or bridge of silver wire designed, I believe, in the first place by Dr. J. B. Murphy and called to my attention by Dr. James Eaves, Instructor in Surgery in Stanford University (Fig. 1). At first the hope was that these supports would be buried in the tissues and remain permanently, but with all of them the result has finally been the same. They have ulcerated through the skin and ultimately required removal. Many, however, have re-

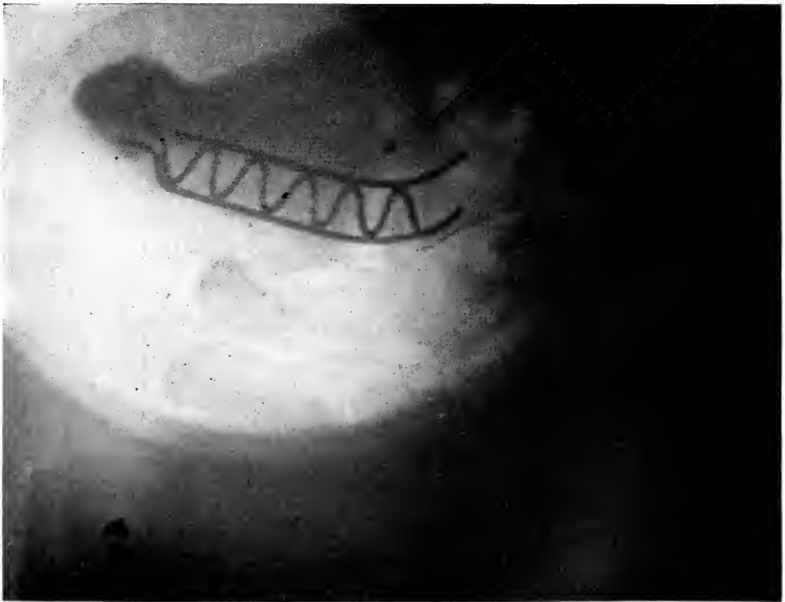
mained in place for a year or more, and I have been surprised to notice how little subsequent deformity there was after removal, when they could be kept in place for six or eight months. While there was practically no new formation of bone, no further cicatricial contraction seemed to take place, and the deformity was very much less than when no effort at all had been made to keep the ends of the bone apart. In some the deformity was hardly noticeable, and the patients were able to masticate reasonably well on the sound side. In cases where it is necessary to remove the anterior or mental portion of the jaw, I know of no device that will so well replace the lost bone as the curved truss hereshown. (Fig. 1.) This is a mutilating operation at best and usually a hopeless one, yet I have one patient who is still wearing the truss eight months after operation and without any signs of recurrence at the present time. In this as in other cases, the truss has become entirely covered up inside the mouth, but has ulcerated through the skin and will soon have to be removed (Figs. 2, 3, 4, and 5). The deformity in these cases is of course very great, but it is by no means so great when the truss is used as when it is not, and if it can be left in place for six months or more there is but little increase in the deformity after its removal. By its use also can be prevented the gravitation or retraction of the tongue onto the larynx which is the cause of much trouble for the first few days after this operation. Murphy has recently used successfully a framework of this kind to take the place of the body of the jaw and the articular process which was removed for sarcoma, and succeeded in getting good functional results; and I hope the result will be permanently successful. After implantation the truss becomes surrounded by a gelatinous granulation tissue, which sometimes persists and sometimes becomes firm cicatricial tissue, which in my experience, however, sooner or later at some point breaks down with the overlying skin, exposing the bridge. I have removed the truss under such circumstances just before the skin broke down, and after changing its shape, replaced it, to have the same result follow a few months later. The grafting of bone into these defects is the ideal and I believe

FIG. 1.



Trusses made of silver wire for insertion after partial removal of inferior maxilla.

FIG. 2.



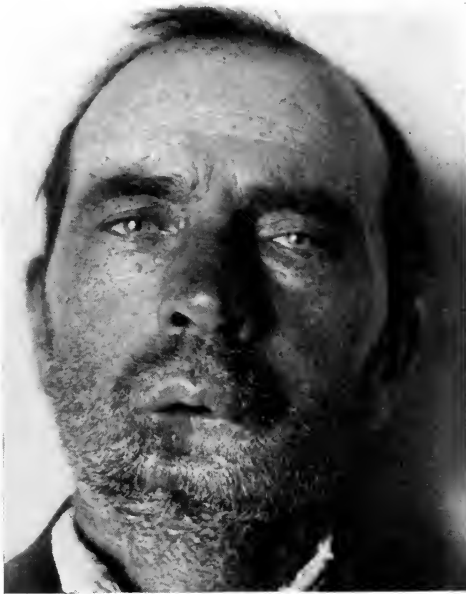
Skiagram showing wire truss in position; lateral view.

FIG. 3.



Skiagram showing wire truss in position; anteroposterior view.

FIG. 4.



Showing external appearance of patient wearing wire truss (as in Fig. 3).

FIG. 5.



Lateral view of patient shown in Fig. 4.

FIG. 6.



Showing prevention of loss of symmetry by bone graft after partial removal of inferior maxilla. Condition nine months after removal.

FIG. 7.



Same patient as in Fig. 6; lateral view.

FIG. 8.



Same patient as in Fig. 6, with mouth open.

FIG. 9.



Showing wire truss supporting jaw after removal from symphysis to angle.

FIG. 10.



Condition after removal of angle of mouth and left side of inferior maxilla from symphysis to angle.

FIG. 11.



Same patient shown in Fig. 10; lateral view.

FIG. 12.

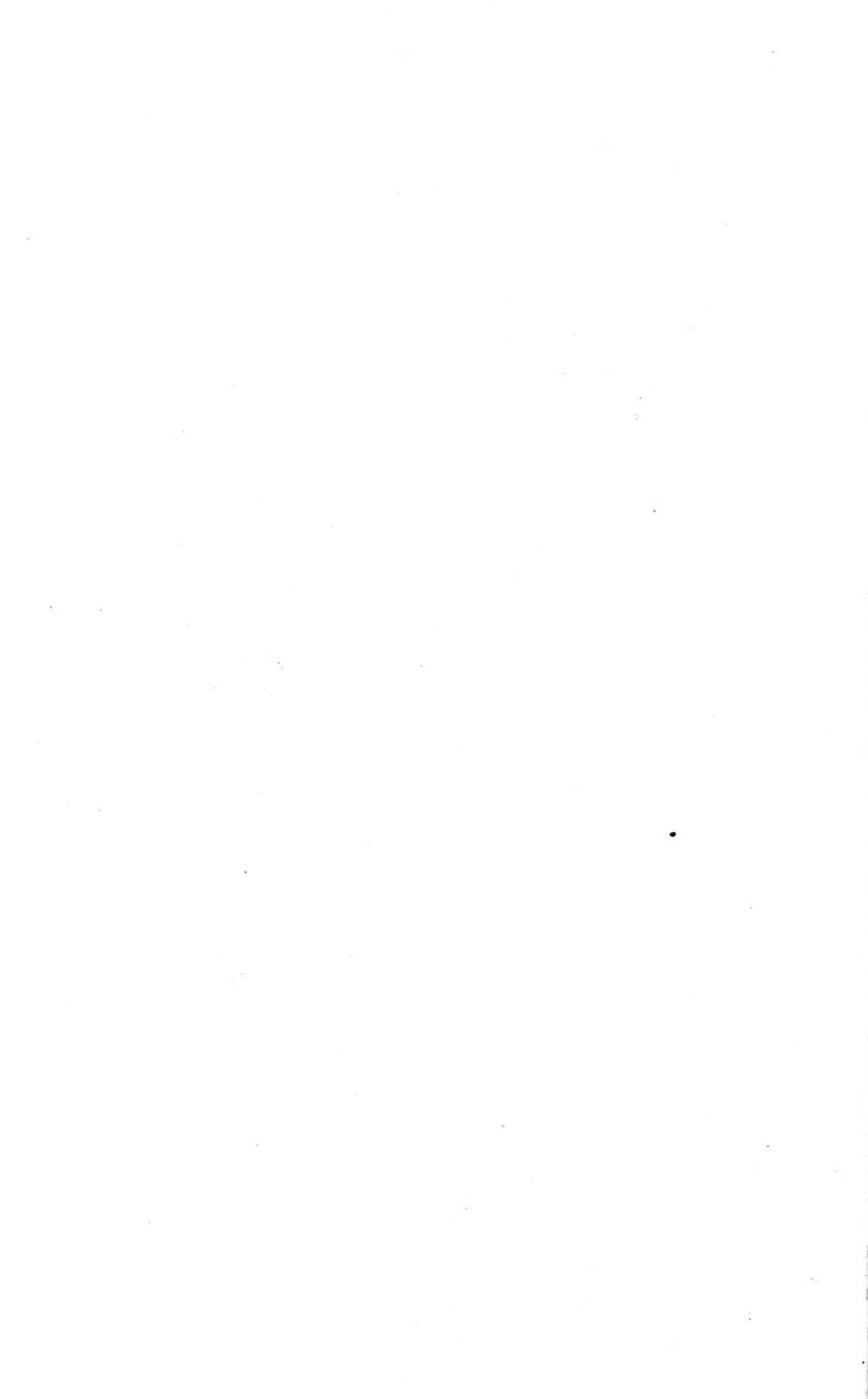


Showing early condition after removal of cheek and part of lower jaw, with plastic flaps from neck to reform cheek, with wire truss to support jaw.

FIG. 13.



Showing wire truss in place after resection of half of body of lower jaw.



the only permanently successful method of maintaining the symmetry and function of the jaw. It is necessary to prevent contraction from occurring during the interval between the removal of the bone and the healing of the wounds, and this may take a month or longer. When the teeth on the sound side are numerous and firm enough to stand the strain, they may be prepared beforehand with the aid of a dentist, so that a few days after the operation they may be clamped firmly to those of the upper jaw. While all of the teeth are loosened somewhat under the strain and the patient is not altogether happy, deformity has been prevented this way until the wound was healed and I could separate the flap, freshen the ends of the bone, and wedge in between them a section of rib. This takes the strain from the teeth, and the clamps are left in place until the bone is firmly united—six or eight weeks later. I have had but one case in which I was able to do this successfully, for the age of the patient is generally such that the teeth are too few or too loose or decayed to stand the strain. In this case (Figs. 6, 7 and 8), which was presented to the Clinical Society at its meeting in San Francisco last year, the grafted section of bone had to be subsequently removed in order to reach a recurrence of the growth in the floor of the mouth, but by anchoring the teeth contraction was prevented so that at the present time, nine months after its removal, there is scarcely any loss of symmetry with the mouth open or closed, as can be seen in the photographs, and the teeth can be brought together on the sound side so as to permit of satisfactory mastication, although the left side of the jaw is gone from the angle to the lateral incisor. The patient is so well satisfied with his condition that he does not wish to submit to the insertion of a piece of rib a second time. In cases where the teeth cannot be utilized, contraction may be prevented by the temporary use of the silver truss or bridge; and if necessary this may be left in place for months until conditions are favorable for bone transplantation. Then it may be removed and a section of rib inserted in its place. This plan, for reasons stated above is the one that will have to be most frequently employed, and

while the bone grafting is not always successful, it should be so in a large proportion of cases with proper technic. In cases where the loss of soft parts has not been too great, the mucous membrane of the cheek should be sutured to that of the floor of the mouth or the side of the tongue, and it is generally possible to get primary union in these cases, except at the line of section in front near the incisor teeth where it is usually not possible to cover up entirely the cut surface of the bone. The sutures should be placed so that the knots are toward the buccal cavity. The ends of the truss or bridge should then be inserted into holes drilled into the bone and the skin flap sutured over it with provision for drainage at each end of the incision. The posterior drainage opening usually closes promptly, but the anterior one takes time and sometimes does not heal until a small sequestrum is separated from the maxilla. When it has finally healed and the conditions are favorable for bone grafting, the wound may be reopened, the truss or wires removed, and all granulation tissue thoroughly scraped out, the wound enlarged sufficiently to receive the graft without opening the oral cavity, the ends of the bone freshened, the graft put in place, and the wound sutured without drainage. The original wound may suppurate, but it will rarely occur if sufficient care be used in preparation of the mouth and teeth; this means in many cases the removal of all remaining teeth, certainly all useless or decayed ones, and those that are preserved should be thoroughly scraped and polished by a dentist beforehand. If this is thoroughly attended to there is little tendency to infection. Figs. 9, 10 and 11 were taken two weeks after operation on a case of epithelioma originating in the alveolar process of the left side of the jaw and involving the buccal mucous membrane. The few remaining teeth were extracted previous to operation. There was primary union of both mucous membrane and skin. The angle of the mouth was removed at the operation together with the jaw from near the symphysis to the angle. The submental and submaxillary glands were removed at the same time, the cervical glands later. The truss was removed three months later, for the

reason that the skin was about to break down over it at one point. Its shape was changed and it was replaced but was finally removed a few weeks later on account of recurrence in the cheek. Following this later operation there was remarkably little cicatricial contraction and the deformity due to loss of the jaw is surprisingly slight. If the loss of the buccal mucous membrane is too great to permit of suture, it will be necessary to turn in a flap from the lower part of the neck to form a new lining for the mouth, and often another flap from the neck to cover this one, if the skin also requires removal. These flaps usually heal by primary union in my experience when the teeth have been properly attended to; when their pedicles have been severed, after ten days, the flap lining the mouth is sutured to the freshened mucous membrane of the floor of the mouth and the side of the tongue, and between it and the external skin flap is placed the silver wire truss, to keep the ends of the maxilla the proper distance apart until conditions are favorable for bone grafting. In some cases this condition never occurs and the truss has to be removed, but the result, as has been stated, is very much better than if no truss at all had been used; the accompanying photograph illustrates such a case (Fig. 12). It is one of cancer of the lip treated by X-ray until the growth had extended from the angle of the mouth to the last molar tooth. The photograph was taken the middle of January, one week after replacement of the pedicles. The granulating surface below the clavicle indicates the portion of the flap that was used to make the lining of the mouth. The posterior drainage opening was closed but there was still some discharge from the anterior opening. At the present time the truss is still in place, but multiple skin metastases have developed all over that side of the neck and the condition is hopeless. With subperiosteal resection the problem is simpler; in cases of necrosis the sequestrum should not be removed until the involucrum is sufficiently developed to maintain the shape of the jaw; or if this for some reason must be done, the jaw may be fixed by some form of interdental splint or the ends kept apart by a plate until new bone has filled

in the defect, which it can generally be depended upon to do. In benign tumors the periosteum can generally be preserved and regeneration of bone hoped for, the cut ends of the bone being kept separated by a plate in the meantime. I have never had the pleasure of dealing with a benign tumor, however, large enough to call for removal of the entire thickness of the lower jaw. In the absence of the periosteum there is often a considerable quantity of new bone formed from the cut ends, and, following Macewen's work, I have recently been trying some experiments to see if this could not be encouraged to such an extent as to fill in a gap of a couple of inches, by substituting some other membrane for the periosteum; and while something has been accomplished, I am not able as I hoped to report positive results. In the few cases in which I have successfully transplanted bone into the jaw I have used sections of rib with the periosteum attached, and in one case in which the fragment had subsequently to be removed, after a lapse of several months, on account of recurrence in the floor of the mouth, bony union was perfect and the shape and appearance of the grafted rib was the same as when it was inserted. Whether a rib without periosteum would unite in the same way or merely act as a bone filling to be replaced by bone growing into it from the cut ends, I am not able to say. I have used wire or a truss many times in cases that were practically hopeless at the time of operation, so far as ultimate recovery was concerned, and the truss particularly has been proved to be of great assistance. The experience gained from its use will lead one to hesitate less to do early radical work in cases of malignant growths involving the gums or alveolar process of the lower jaw, and has led me long ago to abandon any attempts at intra-oral work in such cases, the results of which have been almost uniformly unsuccessful in my experience. I do not hesitate to remove any portion of the inferior maxilla that necessity requires, feeling confident that if the disease does not return, permanent deformity resulting from such removal can be prevented by the use of the truss at the time of operation, and subsequently by bone grafting.

SURGERY OF THE THYMUS GLAND.*

BY CHARLES H. MAYO, M.D.,

OF ROCHESTER, MINN.

A PROBLEM of fundamental importance in the science of medicine, and one, the solution of which would radically change some present indefinite symptomatology, aimlessly directed therapeutics and erroneous records of mortality, is that of the so-termed internal secretions.

Because of this problem's importance in the advancement of medical knowledge, any contribution to the subject, even if it serve no other purpose than to help stimulate a more general practical interest in the question, has a reason for its existence.

In reviewing the rather extensive work which has already been done we find that attention has been focussed mainly upon the following structures: the hypophysis, thyroid, parathyroids, thymus, pancreas, adrenals, testes, ovaries, the lymphatic and the chromaffin system. Whereas the results of investigations prove these to be very important factors in the complex processes, yet evidence indicates and it seems plausible to assume that still other structures of the body are to be considered in this relation. The reported increase of adrenalin in the blood in association with the hepatic affections (Kostlivy), experimental observations on the prostate (Frisch) and the like, are significant in this regard.

In analyzing the results of experimental, clinical, histologic and pathologic investigations which the literature presents, one cannot but be impressed by the frequent lack of uniformity. For some experimenters to have observed practically negligible ill effects from extirpation of one of these organs, while others noted a train of serious disturbances resulting in death, seems

* Read by title before the American Surgical Association, May 31, 1912.

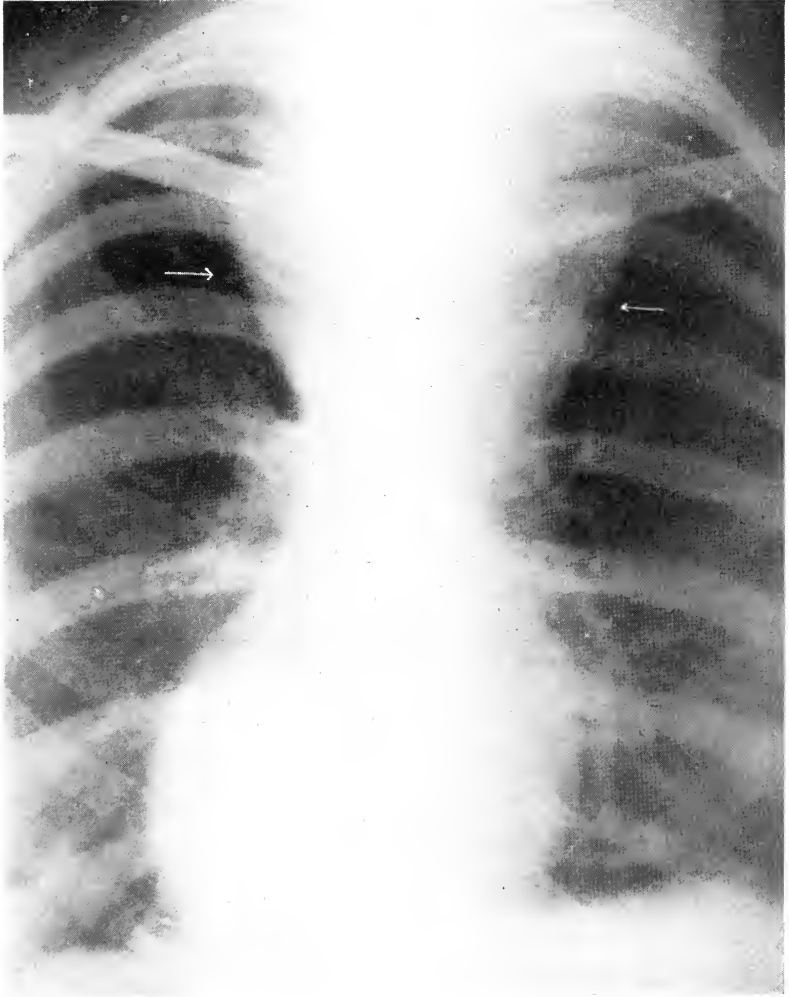
to indicate errors somewhere in the fundamental principles of experimentation. Likewise in the interpretation of the normal in these structures, we see a diversity of views, traceable to a neglect of essential considerations, such as the exclusion of pathologic effects. Hart has pointed out this source of error in the estimation of the thymus, which, he maintains, is commonly affected by the ordinary diseases of childhood. Disturbances, and even death, have been positively ascribed to organs, whose changes might be only compensatory or vicarious, resulting from a correlation with the true causative factor.

It is obvious, that for accuracy and uniformity of experimental results, parallelism of all the essential factors concerned is a *sine qua non*. As is commonly appreciated, this parallelism includes animal species, litter, period in the functional life of the organ investigated, functional status of the correlated structures, general conditions, etc. Whereas, a parallelism of some of these factors is more or less readily attainable, yet, it must be admitted that there are others, the determination of which is, at present, fraught with seemingly insurmountable difficulties.

However, despite their evident indefiniteness, the many observations have emphasized one important fact, namely, that in our investigations of these structures their correlation in physiologic function and pathologic disturbances must be constantly before the mind.

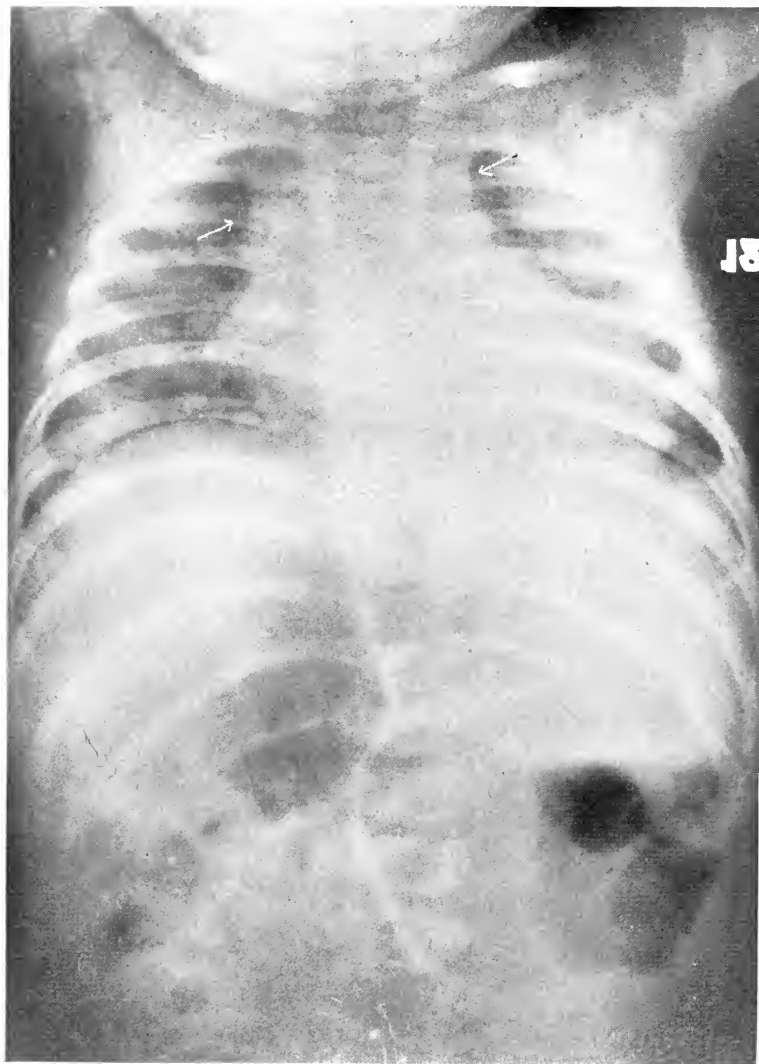
The association of thymic changes with pathologic conditions has long been noted. As early as 1614 Plaster discussed the so-called "thymic death," and reported cases. Since Plaster's time numerous contributions to the subject of the thymus have been made. Of the older works on the subject that of Friedleben (1858)—"The Physiology of the Thymus Gland in Health and Disease from the Standpoint of Experimental Investigation and Clinical Experience"—is one of the most comprehensive. A valuable and exhaustive contribution in recent times is that of Hammar (1909): "Fifty Years of Thymus Investigation." In this "critical review of the nor-

FIG. 1.



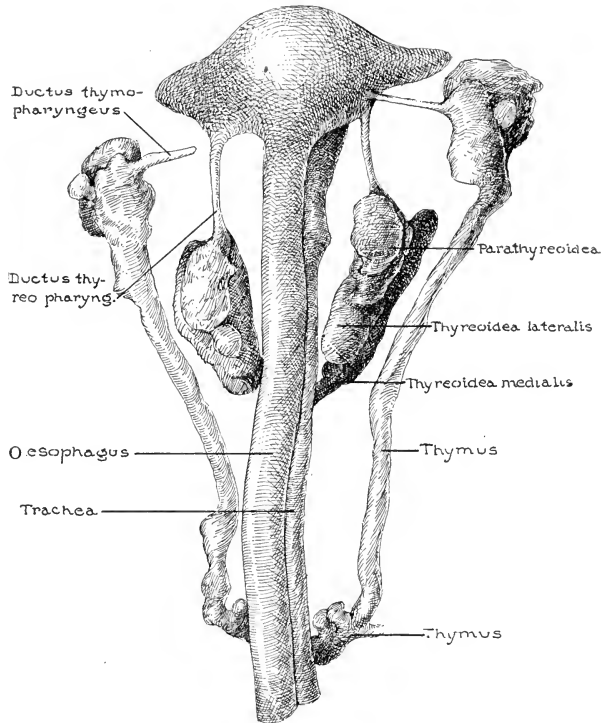
Intrathoracic goitre. Confirmed at operation.
Case No. A62264, X-ray No. 14125.

FIG. 2.



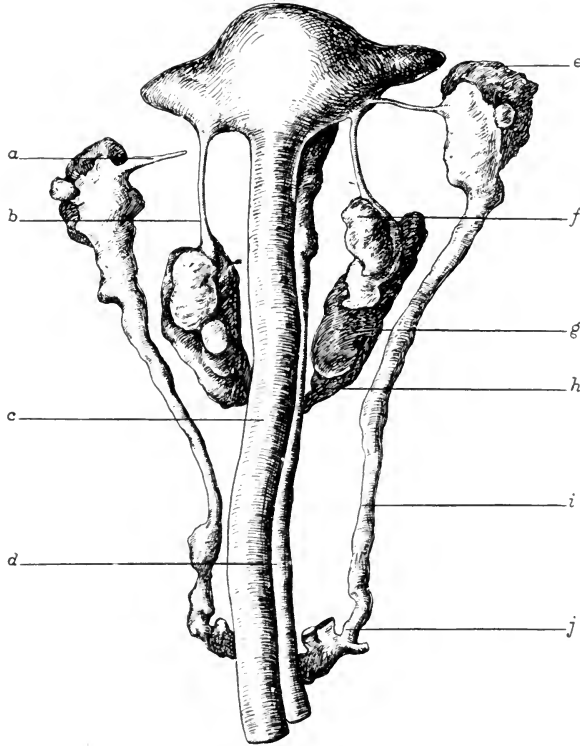
Enlarged thymus. Confirmed at operation.
Case No. A56897, X-ray No. 12820.

FIG. 3.



The anlagen of the thymus and thyroid of a human embryo, 18.5 mm. View from behind.
(After Kollmann).

FIG. 4.



Development of thymus and thyroid (from Kollmann's Atlas). *a*, thymopharyngeal duct; *b*, thyropharyngeal duct; *c*, œsophagus; *d*, trachea; *e*, parathymus; *f*, parathyroid; *g*, lateral thyroid; *h*, medial thyroid; *i*, thymus; *j*, thymus.

mal morphology," besides discussing the various morphologic elements in the thymi of different species of animal, including man, Hammar presents a quite complete bibliography of the subject up to the time of writing. This work seems to be viewed as authoritative and Hammar is freely quoted by most writers on the subject. Although agreeing with Hammar in the main, Hart, basing his convictions on the examination of 300 cases, believes that the former has not duly appreciated the thymic changes resulting from the diseases of childhood.

It is impossible to review much of the enormous amount of literature which has been published within the past 300 years upon the thymus and not feel that our knowledge of its function is indeed very limited. At the same time we are impressed in a vague manner with the fact that the gland is very useful, and that it apparently works in harmony with the other ductless glands of the body. Nevertheless, much of the importance attributed to it surgically must be erroneous.

There is a wide divergence of opinion as to the normal size and weight of the thymus. A persistent thymus throughout life is a common condition. It is claimed by some authors that the surgeon should ascertain the size of this gland in all cases before operating for goitre, and, if it be persistent, the operation should not be performed. It is also claimed that an enlarged thymus may be found in all post-operative fatal cases of Graves' disease and, consequently, the gland is always enlarged in this condition. In some of our patients who died from Graves' disease both with and without operation the size of the thymus certainly was not a factor in causing death, since, while persistent in many cases, it was reduced to a vestige in others. It certainly is difficult to differentiate between an enlarged thymus and some substernal goitres (Figs. 1 and 2).

In only one of our cases in which death followed operation for goitre did the thymus appear to be the cause of death. This followed an operation for exophthalmic goitre on a patient forty-eight years of age in whom there was much tracheal stenosis, which was very pronounced during operation, and for

which tracheotomy was indicated. Death occurred one hour after operation. At autopsy the thymus was observed embracing the bifurcation of the trachea, and proved to weigh 56 grams. The ordinary tracheal tube was too short to be effective.

It is probable that the thymus is enlarged more frequently with goitre than with any other condition, yet in the routine work of operating on goitre there seems to be an exceedingly small number of cases in which the persisting thymus presents difficulties. In patients with the thymus so enlarged that the condition can be diagnosed, the effects of operation itself are very rarely fatal, death usually resulting from sepsis or other complications.

It seems probable that some of the reports attributing to "status lymphaticus" the cause of sudden deaths, especially in children, either during or following operation, have been written with a view of distracting attention from the anæsthetic as a factor. Many such instances occur at an age when the thymus should be large normally. In some of the deaths ascribed to "status lymphaticus," in which no great enlargement of the gland was evident at autopsy, it has been taken for granted that there must have been a temporary sudden congestion of the thymus which served the purpose of causing the sudden death and that the enlargement naturally disappeared with this transitory congestion.

The condition "status lymphaticus," as a cause of death, is not to be denied, yet such cases are extremely rare, consequently it is important that, for a better knowledge of the subject, those using the term as applied to sudden death should give the history in detail, all records of the case, likewise the findings at autopsy, in order that the profession may obtain all possible information on this question.

Less than 50 operations have been performed for the removal of the thymus, most of them because of chronic and recurring stridor or dyspnœa. Olivier reports 42 thymectomies with 23 cures. The author states that the operation is an excellent one, since it relieved dyspnœa in 25 out of 28 cases, the

crises of suffocation in 10 out of 12, and the stridor in 12 out of 16. There were 15 deaths in the 42 cases, most of which occurred through sepsis due to the complications of tracheotomy or possibly from difficulties of drainage. Since such complications may occur it is recommended that the operation of thymectomy, which is not difficult, be made before resorting to prolonged treatment by medication or X-ray.

OPERATION.

Technic.—A curved transverse incision, which includes skin and platysma, is made low in the neck. The inner borders of the attachments of the sternomastoid muscles are incised; the sternohyoids are cut across. If the thymus be enlarged, it is seen as a pinkish gland projecting into the neck from behind the sternum, at least during respiration. The gland may now be caught gently with clamps and drawn upon until the fingers can be used for direct traction. The vessels are not large, the fascia which encloses the gland is loose, and there is but little difficulty in clamping and ligating as one lobe is removed. If it be deemed necessary, the second lobe can be elevated and a portion of it removed. In the case operated on in our clinic only one lobe was removed. The relief was immediate and yet there were occasional symptoms of pressure for a number of days. The cure is complete. A drain should not be used unless indications for drainage are urgent. In case it be advisable, a folded strip of rubber tissue should suffice for the few hours during which the procedure may be necessary.

CASE I (A56897).—O. T., male, eleven months old. Examination March 8, 1911. Patient has had difficult respiration from birth, as though from obstruction in the windpipe. He turns blue at times and convulsions have occurred several times. Vomiting is frequent. He is unable to sit up, is easier in certain positions with head thrown back. Attacks of coughing with blueness less frequent than formerly. Area of dulness was found over the upper part of sternum extending about $1\frac{1}{2}$ inches to the right and one inch to the left, from the first rib above to the third rib.

Dulness seemed higher on throwing head back—at least a slight change in lowest border. X-ray (Fig. 2) shadow corresponds to dulness. Diagnosis: Enlarged thymus. Operation at St. Mary's Hospital, August 31, 1911. Extirpation of right lobe of the thymus. Gradual improvement followed. March 7, 1912, reports from the patient show that he is developing into a fat, normal child and is learning to walk.

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Olivier: Jour. de Chir., March, 1912, pp. 233-246.
Plaster: *Loc. cit.*

THE TREATMENT OF SUBCLAVIAN ANEURISM.*

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WITH THE ASSISTANCE OF

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AND

JAMES A. CORSCADEN, M.D.,

THE treatment of subclavian aneurism has been so admirably and completely described by Souchon,¹⁵ Savariaud,¹³ and Monod and Vanverts,⁹ as to render unnecessary further historical or statistical consideration. Of these authors Souchon published in the *ANNALS OF SURGERY* for 1895 a paper in which all recorded cases prior to that time were arranged in convenient tables and the results of treatment carefully given. Savariaud in 1906 collected 55 instances of operation for this condition published between 1884 and 1904, while Monod and Vanverts in the *Revue de Chirurgie* for 1910 has added those cases appearing in the literature since the publication of Savariaud's paper.

Souchon alone deals with conditions in the pre-antiseptic era and his story is a veritable tragedy. Constant attempts continued over an interval of almost a century to cure this condition invariably proved fatal, and frequently secondary hemorrhage, that most appalling and enervating complication, was the cause of death. In the face of such mortality the surgical courage of these pioneers is all the more surprising in view of the fact that conservative measures occasionally cured. Thus Souchon refers to a series of 35 cases, in which 11 recovered after the use of either Valsalva's method, or direct pressure, massage and kneading, assisted by appropriate diet and rest.

The introduction of aseptic methods largely eradicated the danger of wound infection and by that means diminished

* Read before the American Surgical Association, May 31, 1912.

materially the risk of secondary hemorrhage. In fact this complication occurs at present usually only after ligation of the largest arteries, such as the innominate, and for this reason the ligation of this vessel and others of equal calibre is no longer an operation of choice but of necessity only. The prevalence of this complication after ligation of the large trunks is unquestionably due to the relatively high arterial pressure, and even in pre-antiseptic days this is well demonstrated by its greater frequency after ligation of the right than after ligation of the left subclavian. Thus Souchon states that after ligation in 24 cases of idiopathic aneurism of the left subclavian 12 recovered, while of 17 traumatic aneurisms of the same vessel two deaths only occurred, one after ligation of the second part of the artery from cerebral symptoms and the other from secondary hemorrhage due to the slipping of a ligature. Moreover a study of this complication after ligation of different portions of the right subclavian shows that it is less frequent as the third part of the artery is approached. Thus of the ten cases of ligation of the third part of the right subclavian as well as of the seven cases after ligation of the second part, in the combined statistics of Savariaud and Monod and Vanverts, no case of secondary hemorrhage occurred, while in the 17 cases of ligation of the first part collected by the same authors, two deaths from secondary hemorrhage are noted, while after ligation of the innominate during this same period no less than one-third died from this post-operative complication. It is quite clear then that, in spite of asepsis and the improved methods of ligature application, the possibility of secondary hemorrhage after ligation of the largest trunks still persists, and therefore in presenting the report of a case of successful ligation of the first part of the right subclavian, the writer feels justified in discussing whether after ligation at this particular point, at least, there may not be some practical means by which the occurrence of this much dreaded complication may be eliminated. At the same time the different methods of treatment of this particular variety of aneurism—that of the third part of the subclavian artery—will be briefly described.

Aneurisms of the subclavian artery are most frequently found in the first or third portion. According to their relation to the scalenus anticus they are sometimes spoken of as extra- and intrascapular respectively. The second part of the artery placed between the powerful and constantly contracting scalenus anticus and medius is so firmly supported by those structures that primary aneurism rarely if ever occurs, and secondary aneurism develops only occasionally from the extension of a primary aneurism in either the first or third portion.

Before proceeding to the discussion of the operative treatment of this condition, the writer wishes to call attention again to the fact that medical measures, according to the investigation of Souchon, have proved successful in 11 of 35 cases, and that in slowly-growing aneurisms of small or moderate size, such conservative treatment is indicated. The report of the following case is cited to justify this statement.

Mr. F., age sixty-two, referred by Dr. Runyon in 1906. Patient, who has always enjoyed good health and without the slightest suspicion of a specific lesion, accidentally discovered several weeks ago a small pulsating tumor above the inner part of the right clavicle. On examination this tumor proved to be an aneurism extending as far outward as the external jugular vein. From its position it evidently involved the first part of the right subclavian, and would require, in the event of its increasing in size, the distal ligation of the artery. Before this was attempted the patient was treated by rest and diet, and the aneurism perceptibly decreased in size, although it did not entirely disappear. At the present time the patient's condition is quite satisfactory.

Owing to the rarity of aneurism in its second portion, the consideration of the operative treatment of subclavian aneurism is practically limited to aneurisms occurring in the first and third portions of the artery. Aneurisms in the first part of the artery are rarely if ever so situated as to permit of any other form of proximal ligation than that of the innominate. This operation is so frequently followed by secondary hemorrhage, not to mention the danger of a fatal cerebral anæmia,

that, as has already been mentioned, it has ceased to be an operation of choice.

Thus Savariaud has collected 12 instances of ligation of the innominate between 1884 and 1906. In this interval no ligation of choice has been attempted since 1895, subsequent to which year two ligations "from necessity" have been done, one by Symonds in 1899 with success for uncontrollable hemorrhage in the course of a ligation of the first part of the subclavian (the common carotid also tied), and the other by Moynihan in 1897 for secondary hemorrhage after primary ligation of the subclavian, the patient dying (this case was complicated with sepsis). Of the remaining 10, two were of traumatic origin in young subjects and of these the case reported Twynam (1890) died from cerebral anæmia 18 hours after the operation, while Lemtas in 1889 reported a recovery. Of the remaining eight, no detailed account of the history of the patient operated on by Willet is given; two recovered, namely Coppinger's case in 1893, in which the common carotid was also tied, the patient being well two and one-half years after the operation, while Durande's patient was lost sight of ten days after the operation. A patient operated on by Burrell lived for 104 days and then died from myocarditis and its complications. In this case, the artery was tied with a double ligature of silk, and at the autopsy it was found that the lower of the two ligatures had cut through the wall of the artery, with a restoration of its lumen. Three patients died from secondary hemorrhage on the nineteenth (May, 1886), thirty-third (Bull, 1884), and thirty-seventh days (Banks, 1885) respectively. One patient (Helferich, 1887) died from cerebral embolus two days after the operation. Beside the innominate in these various cases, the carotid was tied five times, the vertebral once, the carotid and the vertebral twice, and the carotid and subclavian twice.

That ligation of the innominate should have been discarded as a matter of choice is more than justified by the successful results achieved by distal ligation for aneurisms of the innominate or the first part of the subclavian or of both. Of distal ligation for aneurism of the first part of the subclavian Savariaud has collected nine cases without a death. In four of these in which the common carotid was tied as well, three were completely cured.

In Lloyd's case, the tumor decreased in size and became harder; in Monod's case, the tumor disappeared completely although the pressure paralysis persisted; in Gerard-Marchant's case, the aneurism which had resisted treatment by gelatine injection was completely cured. In the remaining cases, the reported improvement or cure of the aneurism cannot be definitely ascribed to the ligation, as in two cases, those reported by Braun and Carmini, the aneurism was treated simultaneously with electrolysis. Braun's patient was well at the end of two years, while

Carmini's, after temporary improvement, died five months after the ligation from a rupture of the aneurism. In two cases reported by Barkley and Meriwether the result is described as satisfactory. From a consideration of these cases, Savariaud recommends the distal ligation of the third part for aneurism of the first portion of the subclavian, with ligation of the common carotid as well, should the innominate be dilated. In Monod's case the carotid was tied because in some unexplainable way its compression diminished the aneurismal pulsation.

The treatment of aneurisms of the third part of the subclavian by ligation differs essentially from the first portion in that the ligation may be either proximal, distal, or both. Of proximal ligation Savariaud has collected nine cases with two deaths from secondary hemorrhage.

In one case, that of Kammerer,⁵ the patient died three weeks after operation, and an autopsy showed the catgut ligature had in one place cut through the arterial wall. In Pitt's case, the hemorrhage occurred several weeks after operation, also at the point of ligature. In both, this complication occurred without wound infection.

The occurrence of secondary hemorrhage in these two cases cannot be taken as a fair criterion of the danger of this complication after ligation of the first part of the right subclavian, for in Kammerer's case the aneurism developed in a syphilitic subject and in Pitt's case the aneurism, complicated by a cardiac lesion, had involved both the second and third parts of the artery. In both cases it is probable that the strength of the arterial wall at the point of ligation had been seriously impaired by the co-existing endarteritis. Had the aneurism resulted from trauma or had it attacked the artery of a patient otherwise healthy, secondary hemorrhage would probably have not taken place. In the statistics of Monod-Vanverts, the first part of the right subclavian artery was ligated in eight different patients without any case of secondary hemorrhage.

An interesting secondary complication in connection with ligation of the first part of the right subclavian artery is the frequency of relapse. Of these Savariaud reports three and Monod-Vanverts two, altogether five in a series of 19 cases.

In Clutton's^{*} case (1897) the aneurism, the size of a gall-stone, involved the third part of the artery. In the first operation a single ligature

of gold-beaters skin (to which Clutton ascribes the recurrence) was placed around the artery on the distal side of the thyroid axis and internal mammary. The pulsation rapidly returned. In the second operation three months later a ligature of silk was placed around the artery to the proximal side of these same branches, which were also ligated individually with silk as well. There was no sign or trace of the original ligature and the lumen of the artery had been completely restored. Seven days later a ligature of the axillary first diminished and shortly after brought the recurrent pulsation to a standstill. In this case the first ligature had temporarily at least occluded the main vessel, during which time the collateral circulation had become thoroughly established. The second ligature permanently occluded the main vessel and abolished the direct current of blood, but the pulsation did not disappear until the collateral circulation was effectively cut off from the aneurismal sac by ligation of the axillary.

In Lediard's⁹ case the aneurism involved the third part of the subclavian and was as large as a duck's egg. Here also three operations were performed, the ligation of the first part of the subclavian, the axillary, and finally the excision of the aneurismal sac after resection of the clavicle. The aneurism contained no clot but only atheromatous patches.

In Allingham's¹ case the aneurism extended from the sternomastoid to the trapezius. Three days after the ligation of the first part of the right subclavian at the inner margin of the scalenus anticus, the pulsation recurred and in four weeks the aneurism had regained its former size. The clavicle was then resected, the axillary ligated, and the aneurismal sac excised. In the dissection of the sac from the brachial plexus, the adherent subclavian vein had to be ligated and the second part of the subclavian and the transverse coli were also tied. The aneurism was filled with firm clots and the lumen of the subclavian artery was not completely obliterated.

In the two relapses mentioned in the table of Monod-Vanverts, a cure was effected by distal ligation of the axillary.

Of the ten cures, four collected by Savariaud are said to have been complete (Schumfert,¹⁴ reported nine weeks after; Halstead, reported six weeks after; Tuffier,¹⁵ reported one year after; and Kraske reported nine months after). Of the six cures collected by Monod-Vanverts, four were incompletely relieved, as follows: in one, paralysis of the upper extremity persisted; in a second pain still continued eight months after the operation; in a third the circulation of the upper extremity, four months after, was described as bad, and in a fourth there was some motor trouble.

Aneurism of the first portion of the subclavian is rarely so placed as to permit proximal ligation of that part of the artery. Savariaud has collected nine cases in which such a ligation was practised, with one death (reported by Braun) due to cerebral embolus 22 days after operation—a rare complica-

tion under any circumstances. Of the recoveries one patient died subsequently from a rupture of an aneurism of the arch. Another patient remained in good health at the end of four years, and of the others the aneurism was cured but either local paralyses or trophic disturbances persisted indefinitely. In general the end results are described as satisfactory.

Savariaud also mentions four instances of proximal ligation of the second part of the subclavian, all of which recovered from the operation. In two cases of traumatic origin the ligation cured the aneurism. In a third of idiopathic origin (reported by Godler) the patient shortly after developed aneurism of the arch of the aorta.

While proximal ligation of the subclavian wherever it can successfully be carried out seems preferable to distal ligation of either that vessel or axillary, the latter procedure has proved its value as a secondary measure in cases where proximal ligation has been followed by a relapse of the aneurism. Several instances, notably Clutton's,³ have previously been mentioned in which a cure was effected by this means.

A summary of the tables compiled by Savariaud and Monod-Vanverts shows that ligation of the third part of the subclavian is practically without mortality while ligation of the first part of the right subclavian is occasionally followed by secondary hemorrhage. While in pre-antiseptic days this complication not uncommonly resulted from wound infection, the possibility of its recurrence must still be recognized even where suppuration is absent, especially in the ligation of the large trunks near the heart, in which category the first part of the right subclavian must be included. Measures to prevent this complication must logically provide for the formation of a clot of sufficient extent to permanently and effectively seal the artery at the point of ligation, at which point subsequent examination in the cases of Kammerer⁵ and Pitts showed the hemorrhage to have taken place. Even in Burrell's² case an autopsy showed a partial division of the arterial wall by the ligature with restoration of its lumen. The well-known fact that a clot, after ligation of an artery, is longer the greater the

distance between the nearest branches on either side of the point of ligation, has established the advisability of applying a ligature in continuity at a point as remote as possible from any considerable sized branch. In the first part of the right subclavian, however, the proximity of large sized branches makes it difficult to satisfactorily observe this principle, and under these conditions as well as in accidental division of any large vessel near an important branch, the formation of a satisfactory clot is provided not only by the ligation of both ends of the divided artery but by the ligation of any adjacent branches as well. The writer does not wish to imply that the entire brunt of withstanding the high arterial pressure is placed upon the clot alone. The reparative tissue adjacent and superficial to the divided artery shares this burden, and yet, although this is quite true, the fact that the interior clot formation bears the larger share is demonstrated by the fact that fatal secondary hemorrhage after ligation of the innominate has taken place through a healed operative incision. In the case herewith reported the writer tied all the branches of the first part of the right subclavian with the exception of the vertebral, with the object not only of diminishing the risk of secondary hemorrhage, but also by constricting the flow of blood through the aneurismal sac by way of the collateral circulation to diminish the risk of recurrence. In order to still further ensure success, the transversalis coli and the supracapsular were ligated a second time as they crossed the scalenus anticus.

The risk of secondary hemorrhage is still further lessened by the number of type of ligature. Two ligatures should be applied, separated by an interval of from a quarter to a third of an inch, of which the proximal should be tied with sufficient force to oppose the intima and the distal ligature should be tied as tightly as possible. For the proximal, silk or a Halstead ring is used, for the distal, chromic gut. While the writer recognizes the excellent results achieved by the Ballance-Edmunds knot, yet in an artery near the heart it is not inconceivable that this method, as in the case of Clutton, might result in a yielding of the ligatures and the restoration of the

lumen of the artery with subsequent recurrence of the aneurism. In this situation the writer is an advocate of the method suggested. The distal ligature (still on the proximal side of the aneurism) ruptures the intima and the resulting clot, beginning at this point, rapidly forms behind the friendly shelter of the proximal ligature and subsequently probably extends beyond it to the vertebral.

The repair of arteries after ligation is an interesting study and in order to investigate this question as well as to determine the danger of secondary hemorrhage after the ligation of large arteries near main trunks, the following experimental work was conducted under my supervision by my assistants Drs. Jameson and Corscaden. The internal iliac of the cat just below the point of division of the common iliac was selected and the following ligations were performed :

1. Ligation of the internal iliac artery with No. 2 plain gut one-eighth inch from the bifurcation of the common iliac. Vessel cut. Examination about four months afterward showed the ligature still in place and a slight dimpling of the artery at its point of origin. Microscopic examination showed extensive connective-tissue formation at the point of ligature.

2. The above operation repeated. Examination four months afterward showed the proximal part of the artery converted into a mass of connective tissue with the same slight dimpling at its origin.

3. Same operation as above with application of ligature one-sixteenth inch from bifurcation of common iliac. Animal killed two weeks later on account of distemper. Autopsy showed no sign of hemorrhage nor clot. The ligature was still in place and there was a slight dimpling of the artery at its point of origin.

4. Ligation of internal iliac artery in continuity with fine silk one-quarter inch from bifurcation. Examination three months later showed ligature imbedded in connective tissue. Distal to ligature the artery was converted into a thin cord as far as the first branch.

5. The same operation as in 4 repeated with the same result at the time of examination two months later. Microscopic examination showed only connective tissue.

GENERAL CONCLUSIONS.

In these cases the vessel proximal to the ligature was obliterated and converted into a fibrous cord, only a slight dimpling in the wall of the artery persisting at its point of origin.

Distal to the ligature the lumen was obliterated and the vessel was converted into a thin fibrous cord extending as far as the first branch in those vessels ligated in continuity, but in the other cases only a small mass of connective tissue could be recognized.

At the point of ligation fibrous tissue surrounded the artery and the silk ligatures were imbedded and covered in by this new tissue. In none of these cases was there secondary hemorrhage.

Although the treatment of subclavian aneurism by the different ligations which have just been discussed is of classic origin, it must not be forgotten that other methods of treatment have given satisfactory results. Of these the operation of Antyllus and its modification, in which the sac is excised after ligation of the afferent and efferent trunks, are the most conspicuous. The former is especially effective in traumatic aneurisms of recent formation, for in this group the sac is not well-defined and excision is unnecessary and might even be impracticable. On the other hand excision of the sac, even though formed in part by the clavicle, is indicated in all pathological aneurisms as a secondary measure where, notwithstanding both proximal and distal ligation, the aneurism persists. The history of cases treated in this manner shows that the separation of an old sac from the subclavian vein as well as from the branches of the brachial plexus may be quite difficult and that occasionally the sacrifice of the vein cannot be avoided. Under these conditions the exposure and dissection of the aneurismal sac, frequently in old cases a difficult matter, as well as the proximal and distal ligation of the artery, are greatly facilitated by a resection of the overlying clavicle. Such a resection does not materially weaken the function of the shoulder and is always indicated when the clavicle forms a part of the aneurismal wall as well as in uncomplicated ligation of the first part of the right subclavian with or without the additional ligation of its branches.

In the excision of aneurisms of the large arterial trunks the writer wishes to call attention to the fact that the division of the overlying tissues, through a withdrawal of its accustomed

support, subjects the aneurismal wall to a sudden increase in pressure and thereby predisposes to its rupture. Although the writer has found no mention of this accident in the literature, yet in personal communications he has learned of several such unfortunate experiences. The corollary is obvious, namely, that this danger is to be avoided by excision of the sac only after ligation of the arterial trunk on both its proximal and distal sides.

The danger of secondary gangrene of the extremity seems to be comparatively *nil* after either ligation or excision. This is in accordance with the general observation that gangrene is more common the greater the distance from the heart at which the main arterial trunk is ligated.

Of aneurisms of the subclavian treated by excision Savariaud cites two of the traumatic variety treated with success by the method of Antyllus (Miles, 1893, and Taylor, 1903) and seven other cases of excision proper, including a case of his own. Of these two excisions, those of Allingham¹ and Lediard⁶ were practised only after failure of both proximal and distal ligation. In a third (Schumfert), the aneurism had reached such a stage of spontaneous cure that it was mistaken for a solid tumor. Of the seven cases, one death occurred, that in Moynihan's¹⁰ patient on the fifty-ninth day from secondary hemorrhage. An autopsy showed that the hemorrhage resulted from the rupture of a new aneurism nearer the heart. In the case of Tuffier,¹⁶ excision was attempted, but owing to the intimate adhesions between the vein, the branches of the brachial plexus, the clavicle, and the sac, the operation could not be completed. This case, previously cited, was well at the end of a year. Savariaud's table does not include the case of Halstead,⁴ of Chicago (1892), cited by Souchon, in which an aneurism of the left subclavian was excised together with the overlying clavicle and adherent vein in one piece after ligation of the first part of the subclavian as it emerges from the chest. This patient made an excellent recovery, and was the first successful result of ligation of the first part of the subclavian for aneurism.

Although with very few exceptions the operative treatment

of subclavian aneurism has consisted in some form of ligation of the artery or of excision of the sac, there are in the literature several instances in which endoaneurismorrhaphy—the operation of Matas—has been attempted. Ordinarily this operation requires effective hæmostasis and is therefore especially adapted to the treatment of aneurisms of the extremities in which this desideratum can be well supplied by the application of an Esmarch bandage. In subclavian aneurism complete hæmostasis is possible only after preliminary ligation of both the proximal and distal arterial trunks, and to conform to the principles of the Matas operation these ligatures must be so applied that, on the completion of the closure of the sac, they can be removed and the normal lumen of the artery be restored. To fulfil this condition the Halstead bands are less likely to damage the intima than any ligature of silk or gut. That both proximal and distal ligation are necessary is well demonstrated in the following cases:

Lilienthal⁷ applied a temporary ligature of chromic gut about the first part of the right subclavian half an inch from its origin with sufficient snugness to obliterate aneurismal pulsation. After being emptied by compression, the aneurism refilled slowly and continued to refill although more slowly after a similar temporary ligature of the carotid. The sac was then incised and a column of blood welled up four inches in height and was controlled by digital pressure. The subclavian was then tied at the point of the temporary ligature with a Ballance-Edmunds knot and the carotid permanently tied and the incision in the sac closed with catgut. Three months afterward a small hard mass only could be felt, and although no pulsation could be detected in the radial, the circulation in the extremity was satisfactory.

Pringle¹² placed a clamp on the proximal side of the aneurism and a loop of strong silk on its distal side to obliterate by traction the lumen of the vessel at that point. On opening the sac, the hemorrhage was so free that it could be controlled only by a clamp on the distal side as well. The sac was then sutured with fine silk and the clamps removed. No bleeding took place.

Lozano⁸ tied the first part of the right subclavian within the scalenus. On incising the sac there was free hemorrhage which was checked by ligation of the superior intercostal and the internal mammary. The aneurismal sac was then obliterated by endoaneurismorrhaphy. Recovery followed. The radial pulse could be felt six hours after the operation.

E. D. Martin and F. W. Parham¹¹ tied the first part of the right

subclavian after resection of the inner three-fourths of the clavicle for fusiform aneurism of the second and third parts of the artery. On incising the sac, violent hemorrhage took place and was checked only by ligature of the opening leading into the sac as well as of that leading into the artery beyond. A cure was the result.

To complete the series of cases of endoaneurismorrhaphy for subclavian aneurism the case of Munro cited by Matas, in which the mere statement of the fact that a cure resulted, may be mentioned.

The great advantages of the Matas obliterating operation in general are that it almost always permanently cures the aneurism, that the risk of secondary hemorrhage is very slight, that gangrene of the affected vessel is rare, and that the mortality of the operation is negligible. Thus, in the latest statistics gathered by Monod-Vanverts, of 103 cases there were 89 cures (of 149 reported by Matas there were 133 cures). Relapse occurred in 1.5 per cent. Secondary hemorrhage occurred once in 63 cases of the obliterating operation and only twice in 23 cases of restorative aneurysmorrhaphy. Gangrene was observed in from 3 to 5 per cent. and there was a mortality for which the operation was directly responsible of 3 per cent.

Equally good results are shown by the same authors in an analysis of 205 cases, to have been achieved by excision. Of these 90 per cent. were cured. One and one-half per cent. relapsed. There was a mortality of 3 per cent. and although, theoretically, the dissection of the sac must sacrifice many vessels, on the conservation of which the establishment of an adequate collateral circulation may depend, there was only 4 per cent. of gangrene.

On the other hand analysis of 138 cases of the different forms of ligation by the same authors showed 74 per cent. cures, 12 per cent. relapses, six and one-half per cent. gangrene and a mortality of 7 per cent.

The inference is obvious that considering the subject as a whole, obliterating endo-aneurysmorrhaphy and the treatment of aneurism by excision are of equal merit and superior in every way to ligation. That on the other hand, restricting the discussion to the treatment of subclavian aneurism only, the inferiority of ligation is not so apparent, chiefly because

of the lack of a sufficient number of cases in which the Matas operation has been attempted in aneurism of this variety. At the same time it is interesting to note that such astute observers as Monod and Vanverts do not believe the Matas operation to be suitable for subclavian aneurism or for those at the base of the neck.

The same paucity of cases of subclavian aneurism treated by the Matas method makes it difficult to reach any just conclusion regarding the comparative value of this procedure judging by the character of the end-results. Even in the more frequent aneurisms of other arteries Monod and Vanverts state that, while the cure or failure is recorded, any mention of subsequent disturbance of the circulation, other than gangrene, is rarely given. Probably more detailed information would show that, while the aneurism proper had been cured, some impairment of the circulation had led more or less permanent motor, trophic, or sensory disturbances, and that the utility of the extremity had been correspondingly affected. Certainly it has been conclusively shown that disturbances of this character have not infrequently persisted after the treatment of subclavian aneurism by both ligation and excision. On the whole the writer shares the opinion of Monod and Vanverts that the results of the treatment of subclavian aneurism by ligation or excision are not inferior to those which might be obtained by the Matas method.

In conclusion it may be stated that the most satisfactory treatment in aneurism of the third part of the right subclavian (or of either subclavian) is a ligation of the first part of this artery together with its branches, with the possible exception of the vertebral; that such simultaneous ligation of the branches diminishes both the risk of secondary hemorrhage and the possibility of subsequent relapse of the aneurism; that, in the event of a recurrence, a cure may be effected by distal ligation of the axillary as close to the aneurismal sac as possible; should the aneurism again recur, excision of the aneurismal sac after the ligation of the main arteries supplying it should be attempted; that these various operations are facilitated by

a preliminary resection of the clavicle and if necessary of a portion of the manubrium as well; that in many cases a cure of the aneurism is marred by some permanent disturbance of the extremity, either motor, sensory, or trophic; that unfortunately these patients are prone to the subsequent development of a fatal aneurism of the aorta.

L. C., male, age fifty-three. Gas-fitter, admitted to the Presbyterian Hospital November 26, 1910. Referred by Dr. James Law. Patient gives a history of the excessive use of tobacco and alcohol. Twenty-four years ago patient had urethritis and states that he had a chancre. Apart from this, there is no definite history of syphilis. Patient at different times has suffered moderately from chronic rheumatism.

Eight months prior to admission to the hospital patient first noticed pain and parathesia in the right arm. There was also burning pain in the right scapular region. He was treated for rheumatism in one of the dispensaries of this city. One month later patient noticed for the first time a swelling in the right suprascapular region. The pain in the right arm had continued and was sufficiently severe to confine the patient in bed for five weeks.

On admission examination revealed a swelling having expansile pulsation in the right suprascapular region the size of a large orange, extending as far forward as the posterior border of the sternomastoid and backward to within several inches of the point of the shoulder. The tumor could not be seen in the axilla but on palpation it could be easily mapped out between the finger in the apex of the axilla and the other hand above the clavicle. There was a distinct thrill, a systolic murmur, and a diastolic shock. The expansile pulsation was synchronous with the heart beat and the cardiac second sound was accentuated and high-pitched. The murmur over the aneurism was transmitted for a short distance up the carotid but a longer distance down the axillary. The radial pulses were symmetrical and the arterial tension in this artery was somewhat higher than normal.

The patient was placed in bed with restricted diet, and at the end of three weeks the blood-pressure had materially decreased and the pulse was slower. The aneurism proper showed no improvement, and therefore operation seemed advisable.

Operation (December 12, 1910).—Under gas and ether anæ-

thesia the first part of the subclavian artery was exposed through the usual V-shaped incision at the inner part of the clavicle, the sternomastoid, the sternothyroid, and sternohyoid being divided and the inner extremity of the clavicle removed. The common carotid was first exposed together with the internal jugular vein and the pneumogastric nerve. A temporary ligature placed around the carotid did not affect in any way the aneurismal pulsation. The subclavian artery in its first part was then exposed, and the interesting fact was noted that although both the internal jugular vein and the pneumogastric nerve are on a decidedly posterior level to the carotid artery, they crossed the first part of the subclavian without any angle whatever. If the subclavian and carotid were given off in the same lateral plane from the innominate, the above-mentioned structures would naturally cross the subclavian at an angle. The fact is, however, that the innominate divides in such a way that the subclavian lies much behind the level of the carotid. This is of importance in accounting for the unusual depth at which the artery lies. As the dissection was continued, the phrenic nerve, crossing the artery obliquely from without inward, was exposed and held to one side. The sympathetic nerve was also recognized and avoided. No structure resembling the right lymphatic duct was seen. The branches of the subclavian were then exposed and tied with chromic gut. A silk ligature was then placed around the artery near its origin and tied so as to snugly oppose the intima while a second ligature of chromic gut was placed about one-third of an inch on the distal side of the silk ligature and, like the ligatures around the branches, was tied as tightly as possible.

Aneurismal pulsation immediately ceased after the application of the first ligature. Before the closure of the wound the suprascapular and transversalis coli vessels were also tied in front of the scalenus anticus. The divided muscles were then sutured, and the skin closed in the usual way. The patient did not suffer in the least from the operation and healed primarily. Twenty-four hours after the operation a slight flicker was felt in the radial artery and the slightest possible pulsation was felt for a few hours in the aneurismal sac. The arm felt slightly numb. At no time was there any thrill over the aneurismal sac.

Four days after the operation, the radial pulse, though feeble, could be distinctly felt. There was no longer any pulsation in

the aneurism, but a faint murmur could be distinctly heard, although the source of the murmur was questionable and it was thought that it might be due to a roughening of the aortic valve.

Ten days after the operation the right radial pulse was ten beats less frequent to the minute than the left radial pulse, and this difference has persisted ever since. The aneurismal sac is becoming firmer and evidently beginning to consolidate. One month after the operation, the aneurism had greatly decreased in size and only a hard firm mass the size of a golf ball remained. From this time on as further shrinkage took place, the supra-scapular fossa began to be drawn in.

Seven weeks after the operation the patient was allowed to begin to walk and shortly after left the hospital. At that time all ordinary movements of the arm were permitted with the exception of abduction. Ten months later, as the patient returned to work, this motion also was allowed, and notwithstanding the resection of the inner part of the clavicle could be carried out almost as well as on the opposite side. At the present time the patient is in very satisfactory condition and able to earn his living as a gas-fitter. During the past winter during the very cold weather he states that it was more difficult to keep the right arm warm than it was the left. This seems to be the only manifestation of the decreased circulation in the extremity.

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ON DRAINAGE AFTER INTRATHORACIC OPERATIONS WITH SPECIAL REFERENCE TO THE ŒSOPHAGUS.*

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THE effect on the pleura of mechanical irritation, as it occurs in the course of intrathoracic operative work, is different from that upon the peritoneum. Whereas the latter usually answers with the formation of adhesions, the pleura frequently throws out an exudate, which, within a very short time, fills more or less the entire pleural cavity.

It may be worth while to mention right here that this exudate is found only when the lung as such has been left in place. It is not found after aseptic pneumectomy. If one pleural cavity of a dog has suddenly been deprived of its contents, not fluid but air will fill the cavity. We have found this in all our total extirpations of one lung, an observation which suggests the thought that the pulmonary pleura may be principally responsible for the exudate.

If the fluid is sterile and remains sterile, gradual absorption is the rule. If it is infected, it needs exit, and the sooner the better. When sterile, the color of the fluid is that of ordinary serum, clear and yellowish; when infected, it is turbid and sero-sanguinolent. Aspiration of the exudate, done with the help of Potain's or Dieulafoy's apparatus, is of no avail, as it reaccumulates in a short time.

Another occurrence to be reckoned with is the entrance of air into the closed pleural cavity. In the event of an injury to the lung, for instance, there is likely to follow a steady escape of air into the pleural cavity, which, in turn, would cause the most dreaded and deadly of all complications, the

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so-called "pressure pneumothorax." Suture of the lung cannot always prevent it; sometimes the very stitches placed to close the injury produce new leakage, and in instances of severe injury the wound cannot be closed at all.

Danger of air entering the pleural cavity exists also in connection with operations upon the œsophagus, when followed by air-tight closure of the thorax. The human œsophagus is extremely thin, its muscular coat very friable; stitches tear out easily. In the endeavor to make them hold, one is apt to penetrate into the lumen. The suction-cup effect of the closed pleural cavity—there being negative pressure in the latter and atmospheric pressure within the œsophagus—will then with each inspiration aspirate air through the penetrating stitch-holes. The result is a combination of infected serosanguinolent fluid effusion with pressure pneumothorax, followed by sudden death.

In view of such experiences and the not unfrequent occurrence of acute infection of the pleural cavity, in spite of most careful asepsis,¹ it was but natural that surgeons be-thought themselves of drainage.

However, drainage had its difficulties. If applied in accordance with generally accepted surgical principles, it was sure to develop a post-operative acute pneumothorax and besides thereby greatly to increase the chance of infection of the pleural cavity. These dangers have prompted surgeons to close the thoracic wound air- and water-tight, thus giving this class

¹ It is not impossible that old adhesions within the pleural cavity harbor encapsulated microbes. Recently, when a branch of the pulmonary artery had been tied for bronchiectasis, the case became infected, necessitating reopening of the wound after 48 hours; in the preceding case of the same kind the wound had healed primarily, with the trouble soon greatly improved. Equal care had been given to asepsis in both cases. Hence the thought presented itself, whether the old adhesions, binding pulmonary pleura to the costal, or to the pericardium or diaphragm, especially shortly after inflammatory intrapulmonary processes, might not be the quiet resting place of microbes. They could become active and virulent in the presence of exudated blood. Investigations in conjunction with the serological department of the German Hospital are now in progress at that institution.

of cases an exceptional position, also as regards the after-treatment.²

To overcome the post-operative acute pneumothorax, therefore, was the task that needed solution.

Within the last two years a number of attempts have been made in this direction. In 1910 Wendel³ conceived the idea of splitting the diaphragm when operating for cancer of the cardia and at the close of the operation stitch it on to the œsophagus in such a way as to place the field of operation intra-abdominally, so that drainage could be accomplished through the abdomen. This method has been tried but once in the human being by Sauerbruch. The result he obtained, as far as the division and subsequent suture of the diaphragm is concerned, was satisfactory.

Last year, Tiegel constructed a flexible metal drainage tube with a rubber valve⁴ (see Fig. 1). It is placed in one angle of the wound, or introduced through a special opening, and forms a part of the dressing. He tried it in one case, in which it worked to his entire satisfaction. A few weeks ago, before the last meeting of the German Congress of Surgeons at Berlin, Tiegel stated⁵ that he had used his valve-drain in several cases with good results.

In the fall of 1909, when planning the new pavilion for thoracic surgery at the German Hospital, it occurred to us that the post-operative acute pneumothorax resulting from intrathoracic drainage could be avoided by leaving the patient under differential pressure for some time after operation. Later, upon trial, with a nurse or doctor enclosed in the cabinet with the patient's head and one or two attendants outside, the plan proved feasible. The air-lock of the cabinet permits an exchange of persons inside, also the carrying

²The attempts to close off certain parts of the pleural cavity by draining with strips of gauze soaked in Lugol's solution have not been very encouraging.

³Langenbeck's Arch., vol. 93, p. 311.

⁴Centralbl. f. Chir., 1911, No. 10.

⁵Berl. klin. Wochenschrift, April 29, 1912, p. 867.

to the patient of whatever refreshing liquids, etc., it may be thought wise to let him have or rinse his mouth with.

Rectal drop instillation and hypodermoclysis, intravenous injections and hypodermic stimulations, practically all that is required within the first 24 hours, at least in the more serious cases, is done outside; also the feeding of the patient through the gastric fistula, which had been primarily established in cases of œsophageal resection. The necessity of having two or three persons attend the patient is somewhat cumbersome. The splendid spirit shown by the house staff as well as nurses of the German Hospital has been most gratifying. In fact, when we drained our first case in this way in May, 1911, many more doctors and nurses than were required volunteered to do the work. However, to lighten the burden of our school nurses, we have of late engaged "specials" to take charge of these patients for the first 24-48 hours. In time we hope to have also a special, trained crew of doctors for this class of cases.

In October, 1911, Green and Janeway⁶ advocated drainage of the pleural cavity for the purpose of overcoming the frequently forming exudate after œsophageal resection for experimental surgery. They proposed leaving the animal with such drainage under differential pressure for 24-48 hours; then (after 24 hours) establishing permanent irrigation with a double cannula up to the place of the anastomosis, meanwhile continuing differential pressure for a short time; removal of drainage on the following day. Up to the time of their publication, the plan had not been tried.

Any differential pressure apparatus, the use of which does not require general anæsthesia, may be employed for the purpose.

Perthes' suction apparatus for the treatment of empyema might probably also be used to advantage, as well as, in special cases, a Bier's suction cup (Tiegel).

⁶ ANNALS OF SURGERY, vol. liv, October, p. 549.

The details of the method so far worked out by us at the German Hospital are as follows:

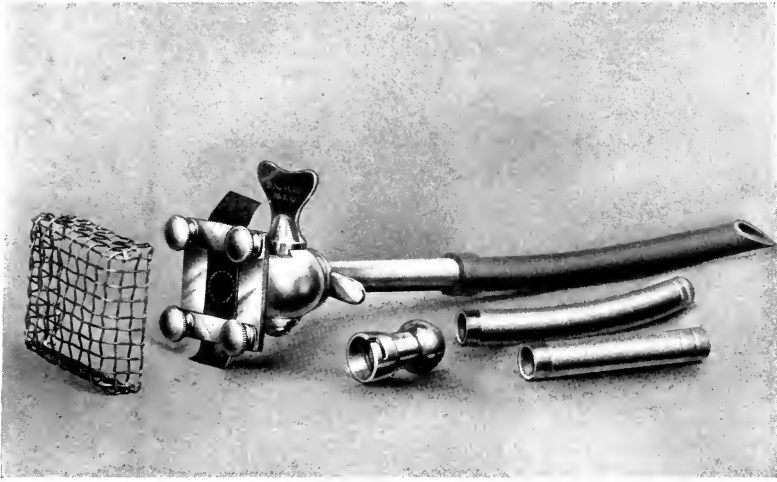
In aseptic cases the wound is closed entirely without drainage and the patient returned to the ward. If drainage appears indicated, an additional incision is made in the complementary space, usually in the ninth or tenth intercostal space, in the scapular line, and one or two drainage tubes are inserted; the original incision is closed. In other words, the same technic as that employed within the abdominal cavity or other parts of the body is followed. Ordinary rubber drainage tubes, split along their longitudinal axis—we call them gutters—are in great favor with us. In resection of the œsophagus, the œsophageal bed in the posterior mediastinum is filled with a long cigarette drain, carrying a central, unsplit rubber tube, and an additional short gutter is introduced on either side of same. The use of the cigarette drain alone has not been found reliable according to our experience; it sometimes acts as a stopper rather than a drain, especially if but a short intercostal stab was made, such as it is customary to make in the abdominal cavity. It is not advisable, however, when draining the thorax, to use short incisions, since in view of the extreme narrowness of the interspaces the ribs are apt to compress the drain. Thereupon a partially divided piece of gauze is pushed under the safety-pins, which secure the drainage tubes, and a large piece of sterile rubber dam is put on top;⁷ a voluminous gauze dressing which includes the arm finishes the dressing. Now the patient is transferred to the after-treatment bed, which is without head-piece⁸ (Fig. 2), and wheeled to the positive pressure cabinet. He thus rests in bed comfortably, just as other patients, the only difference being that his head is inside the apparatus (see Fig. 3).

Had the operation been done in the negative chamber and

⁷ In future cases it is intended to cover the skin of the immediate neighborhood of this wound with zinc ointment (Sauerbruch) so as to insure still better adhesion of the borders of the piece of rubber dam all around the wound.

⁸ Medical Record, June 17, 1911.

FIG. 1.



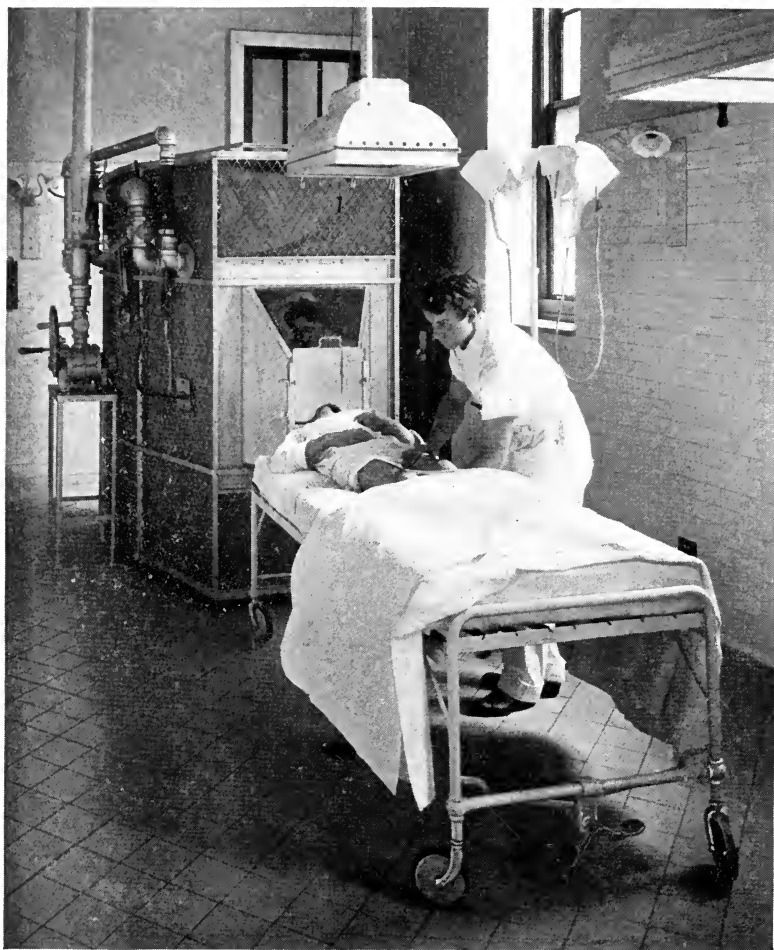
Tiegel's thoracic flexible metal drain. The tube that passes the thoracic wall can be properly bent to correspond with the contours of the posterior thoracic wall. It is advisable to slip a rubber drainage tube of any desired length over the internal extremity of the tube. Note the rubber membrane that covers the external opening and allows the exit of fluid and air, but prevents the entrance of air.

FIG. 2.



Special bed for drainage, thirty inches wide. Height corresponds to positive pressure apparatus. Mattress projects above end-frames. Large, rubber-tired wheels; brake for two.

FIG. 3.

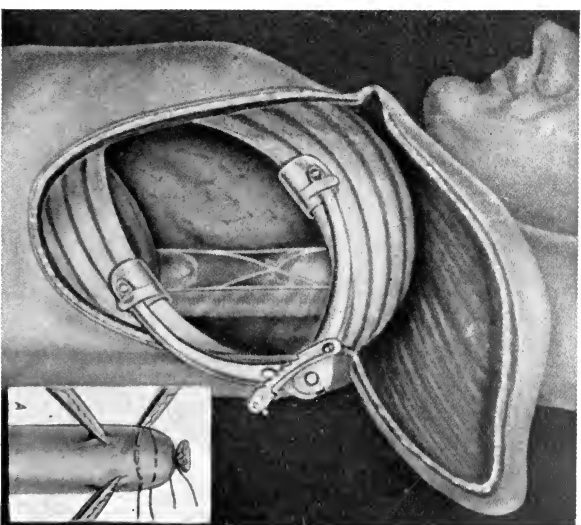


Illustrates the after-treatment of patients with free drainage after intrathoracic operations as now practised at the German Hospital. The patient's head is inside the positive pressure cabinet; a nurse is with him ready to administer liquids or, in summer time, to fan him with fresh air provided by the apparatus itself through a large tube. The patient's body rests comfortably outside, on the bed without head-piece. An attendant is watching the proper administration of a rectoclysis.

FIG. 4.



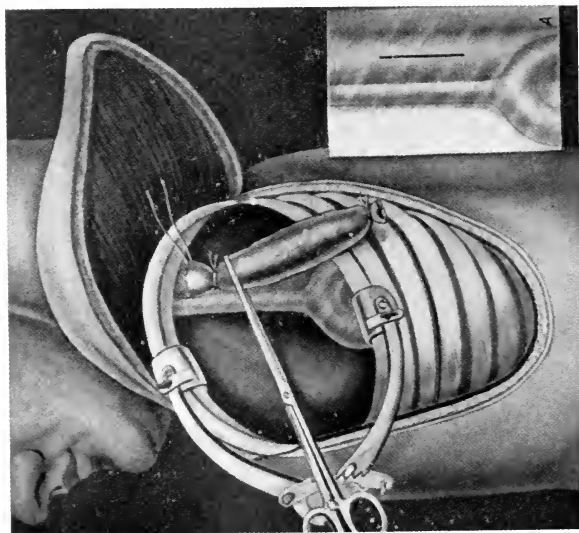
FIG. 5.



The flap raised. With the arm pulled up perpendicularly, the scapula takes a position at right angles with the thorax. When the patient's head is in the differential pressure apparatus, the arm forms a right angle with the thoracic wall. Then by turning the arm inwardly 180° (or the forearm 360°) the scapula moves away from the chest and can be well held out of the way. A, incision in sixth; B, incision in third intercostal space.

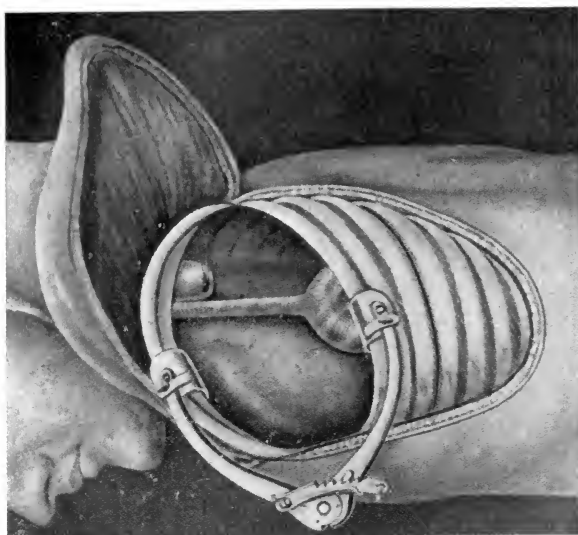
Incision in sixth intercostal space; rib-spreader in place; to the left, lung and diaphragm visible; to the right, the descending aorta still covered by the continuation of the costal pleura, next to it, the esophagus, divided; lower end inverted; the upper tied with silk. Pneumogastric nerves run on either side, with their anterior osculation. A, lower stump of the esophagus ready for inversion, with the purse-string suture in place. It is best to pull the tube apart with three clamps.

FIG. 6.



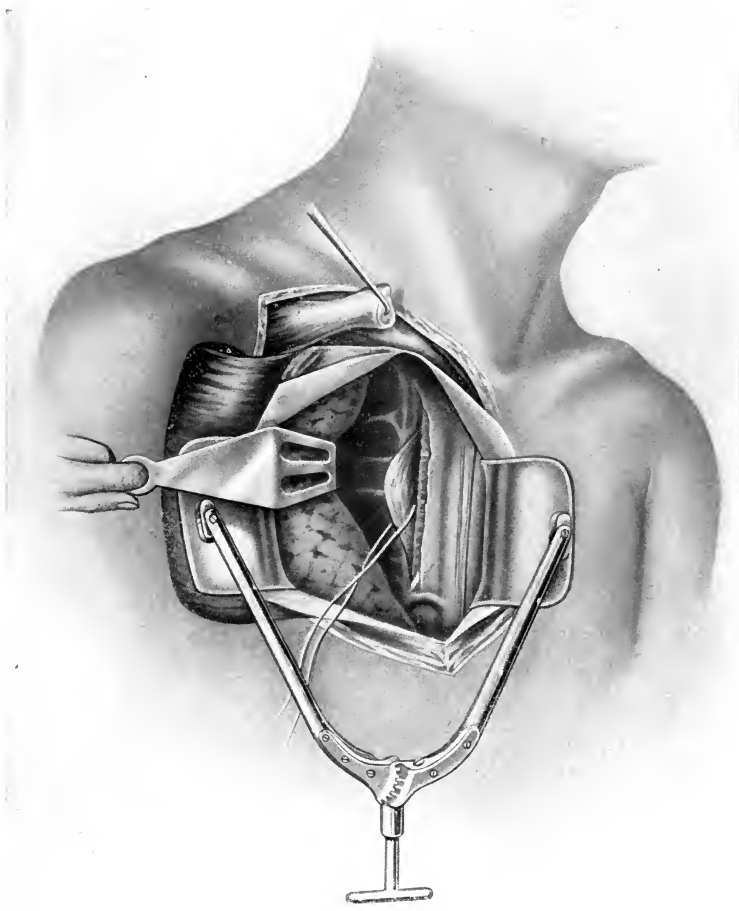
Incision in third interspace; rib-spreader turned around, as scapula is in the way; esophagus exposed by incision about 1 in. to the outside of the common carotid, which remains covered with pleura, as also does the aortic arch (A). The portion of the esophagus harboring the tumor, pulled from behind the aortic arch, tied and clamped, ready to be divided with Paquelin cauter, completing the resection. The first of the two superior purse-string sutures in place, for inversion of upper stump.

FIG. 7.



Interior of the cavity as it appears after completed double inversion of upper esophageal stump. Note below the latter the groove in which the esophagus rested.

FIG. 8.



Sauerbruch's incision to reach the upper portion of the œsophagus from the right side.
(From Sauerbruch-Schumacher, "Technik der Thoraxchirurgie," p. 96.)

the short transport thence to the positive cabinet in the other room seemed inadvisable, if, for instance, both pleural cavities had been opened in loosening the adherent carcinoma of the œsophagus, then the patient's head can be left in the positive cabinet within the negative chamber. In that event the operating table is lowered sufficiently to permit a mattress of the width and length of the operating table to be pushed underneath the patient's body, application of differential pressure continuing meanwhile without interruption. The patient remains therefore under the pressure conditions prevailing during the operation, and the first part of the after-treatment is thus carried on within the chamber.⁹

When the positive pressure apparatus is used, rhythmic changes in the difference of pressure are made for brief periods, every 20 to 30 minutes, in order to relieve the heart, more particularly the right ventricle, and to remove all surplus of carbon dioxide from the lungs. When using negative pressure this will not be necessary, at least not while the pleura is wide open. Whether it will be advisable to change from negative to positive pressure for the after-treatment, as can be done in the universal chamber, further observations will teach.

As to the period of time at the end of which the patient may be safely removed from the apparatus, we first thought that 24 to 48 hours would be the minimum. In trying out the method, however, we were agreeably surprised to find that 12-15 hours was ample. Therefore, after about 12 hours, the differential pressure is turned off and the patient's breathing under ordinary atmospheric pressure observed. If he appears comfortable and pulse and respiration are unaltered, he is transferred in bed to the observation room, where he is left under the care of a nurse. If need be, he can be returned to the apparatus at any moment.

What rôle the rubber dam, covering the wound, plays in allowing the patient to breathe under ordinary atmospheric pressure so soon after the operation, with free drainage of the thoracic cavity, remains to be seen.

* This latter plan has not been tried as yet on a patient.

As regards the class of cases in which drainage is particularly indicated, I believe that next to sutured wounds of the lung (Tiegel) and resection or extirpation of the lung, every operation on the œsophagus, in which sutures were used, should be thus treated. In the former, drainage takes care of whatever discharge of fluid and air there may be; in the latter, especially the cases of resection, it minimizes the dangers of acute infection, besides preventing pressure pneumothorax. By adopting drainage of the pleural cavity as a routine measure after operations upon the œsophagus, we shall, I believe, succeed in improving the prognosis of these operations, including resections.

I take this opportunity to plead the continuance of attempts to resect cancer of the œsophagus in whatever part of the thoracic section of the same it may be located, and do this in spite of the fact that not one patient is thus far known to have recovered. Through the constantly recurring disappointments some surgeons have become discouraged and have given up this work; others have for the present excluded from operation the malignant tumors occurring in the upper two-thirds of the œsophagus, the most complicated to cope with, and confine themselves to dealing with those in the lower third and at the cardia.

Personally, I do not approve of this attitude. If progress is to be made in this most difficult chapter of operative surgery, it can certainly not be done by discontinuing our efforts or limiting them to a certain class of cases. We must keep right on exploring this new field of endeavor, until we strike the right path. The knowledge that the operation is technically feasible, as shown by the experiments on dogs, ought to spur us on to make it practically feasible in the human, since we know that the carcinoma of the œsophagus is the most benign of malignant growths in the entire alimentary canal. The difficulty lies in overcoming the immediate shock of the complicated operation, as well as in steering clear of the many lurking dangers of the early after-treatment.

The principal causes of the problem's having remained un-

solved up to the present day are: (1) the usually advanced stage of the disease, when presented for operation; (2) reduced general condition of the patient; (3) the magnitude of the operation; (4) the difficulty of accomplishing air- and water-tight closure of the human œsophagus in view of its extreme thinness and friability.

The first two causes are intimately connected, and we can hardly hope for any change in the near future. We must, therefore, for the present at least, accept them as given facts. As regards causes 3 and 4, however, there is a fair chance of our learning how to mitigate the effects caused by the same.

The ideal operation, resection with immediately following œsophagogastrostomy, can be done in cases of short annular malignant stricture in the lower third of the œsophagus only. These cases are rare. The type of tumor usually met with in this locality is the infiltrating one, necessitating the removal of several inches of the œsophagus. The proximal stump of the tube cannot be stretched; the stomach, on the other hand, cannot be lifted more than three or at most four inches above the diaphragm, owing to the attachment of the duodenum. Hence, there is in these cases no other course open than to close either stump safely after resection and feed the patient through the gastric fistula primarily established. If the patient recovers, he can chew and enjoy his food, but he cannot swallow it. If he desires this, too—and no doubt the majority of patients will—a new œsophagus must be made. This œsophagoplasty has already been accomplished by Payr and Lexer in cases of intractable cicatricial stricture. Of course in the benign strictures the affected part of the œsophagus may be safely left in place, but in the malignant cases it has to be resected. Every one of the 40 to 50 patients thus far treated with resection has died. The salient point, viz., the recovery of the patient from resection, therefore still remains to be accomplished. If we could get but one such case to recover, the faith of both laity and profession in the possibilities of this branch of thoracic surgery would receive a great stimulus.

Closure of the distal stump is simple, as the latter is very accessible. Invagination by means of a purse-string suture and a few interrupted Cushing stitches on top is all that is necessary. There is no pressure on the suture line from the side of the stomach.

In order to safely and properly close the oral stump of the œsophagus after wide resection in its middle or upper portion, it is necessary to pull it from behind the aortic arch. In advanced cases where adhesions exist, and the tumor is situated at or near the aortic arch, this means serious interference with the pneumogastric nerves at a place where the important branches to heart and lungs are given off and communication exists with the complex sympathetic system. Pulling and tearing at this place, however, is not borne by the pneumogastrics; it invariably causes severe, often irreparable shock. Therefore, in order to minimize as much as possible this principal cause of the severe shock, dissection should be done under the guidance of the eyes. One pneumogastric nerve, after proper cocainization, can be divided, but sharply only, *not* bluntly. If both nerves prove inseparably connected with the tumor at or above the aortic arch, the case appears inoperable.¹⁰ To do this work under the guidance of our eyes we must have proper access. This can be gained by getting the scapula out of the way (addition of Schede's incision) (Figs. 4, 5, 6, and 7).¹¹ The upper part of the œsophagus can also be reached from the opposite (right) side (Sauerbruch,¹² see Fig. 8). The usual incision for œsophageal resection is made on the left side of the thorax. Although I have so far no personal experience in man with Sauerbruch's method of entering the upper part of the thorax I consider the addition of Schede's incision the preferable procedure for wide resection of the œsophagus.¹³ It opens the way to gaining entrance

¹⁰ This important question needs further investigation. It has been shown that below the arch both vagi can, if necessary, be divided, often without any serious consequence.

¹¹ ANNALS OF SURGERY, July, 1910.

¹² Sauerbruch-Schumacher: Technik der Thoraxchirurgie, p. 92.

through any additional intercostal space, in order to follow up the vagi from below the aortic arch as far as necessary upward. Multiple intercostal incisions do not increase the seriousness of the operation.

But to do all in one sitting is inadvisable. The experience gained from four cases of resection of the œsophagus for malignant tumors of the advanced infiltrating type, with the addition of Schede's incision and displacement of the œsophagus from behind the aortic arch, done *in one sitting*, has taught me that this operation is too much of an undertaking in these reduced patients, even though nitrous oxide plus oxygen with carbon dioxide (Yandell Henderson) be used for an anæsthetic.¹⁴ I have, therefore, resolved henceforth to do the operation in two stages, and am at present engaged in working out experimentally a proper plan.

My idea is, to divide the œsophagus below the tumor and attend to the distal stump in the first stage; thereupon, about one to two weeks later, in the second stage, to do a Schede incision and work on the proximal stump. To attack the upper part of the œsophagus from the right side, according to Sauer-

¹⁴ The illustration (Fig. 4.) shows the typical Schede incision as it is required for the multiple excision of ribs. For the purpose of œsophageal surgery we have to divide the borders of the pectoralis major and latissimus dorsi muscles but for a short distance and raise the skin-muscle flaps with the scapula for hardly more than 75-80 degrees. The arm itself is usually not lifted up much more than to a right angle.

¹⁵ Of the four patients three died from shock, which commenced in each instance at the time of bluntly loosening the œsophagus behind the aortic arch and the attempts of *bluntly* separating from it the adherent nervi vagi. In every one of the three operations the narcotizer reported at this time a sudden change of pulse and respiration. He was in the positive pressure cabinet with the patient's head and had been unable to see what had been done within the thorax. The fourth patient, a man of 66 years, had the cancer in the lower third of the œsophagus and no adhesions at the level of the aortic arch. In this operation, too, the œsophagus was transposed in front of the aortic arch, in order to do proper surgical work when performing double invagination of the upper stump. He had no shock, but died from the effects of a large effusion into the pleural cavity of a serosanguinolent fluid, which compressed the lung. This was at a time when we had not yet adopted free post-operative drainage.

bruch, would usually also mean a two-stage operation. The principal difficulty of a two-stage operation lies in the necessity of closing the proximal stump air- and water-tight, as the patient cannot help swallowing saliva down into the closed tract. From what we have seen in operations upon dogs, a silk purse-string suture properly applied and covered by a freely transplanted fascia graft (König) will do the work. The graft, which, in dogs, is best cut from the upper abdominal (rectus) region, from the fascia lata femoris in man, surrounds the convex end of the stump like a rubber finger cot and heals on tightly in a very short time. The strongest pressure exorable by means of a large hand syringe proved the stump absolutely air- and fluid-proof after 30 to 36 hours. Still, as there may after all be some slight leakage in the hours immediately following operation, I shall in man add free drainage of the thoracic cavity for *both* stages of the operation. It will be an additional safeguard against infection of the pleural cavity and pressure pneumothorax.

My conclusion is that the adoption of drainage as a routine measure after œsophageal resection, in fact after any and every operation upon the œsophagus, will undoubtedly be a step in the right direction.

ACUTE PANCREATITIS WITH VERY EXTENSIVE FAT NECROSIS.*

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THE occurrence of extensive fat necrosis is by no means uncommon in cases of acute pancreatitis. Although it is rarely seen in the hyperacute hemorrhage form of the disease, for the reason perhaps that the patient so rapidly succumbs to the intense primary shock, it is frequently observed in the somewhat milder though still acute types, where the damage to the pancreas is not so extensive and where repair of the lesion, without much impairment of function, is still possible.

Very wide variations, both in the extent and character of the fat necrosis, are found. Small, discrete, widely-scattered, pearly-colored patches, in the omental fat and elsewhere, are characteristic of the milder infections, and the severer cases are marked by massive involvement of the omentum, the sub-peritoneal and retroperitoneal fat, the pancreas itself and occasionally by the extension of the process to the pleural and pericardial sacs above the diaphragm.

The experimental work of Frugoni and Stradiotti¹ upon animals which had been injected with pancreatic juice obtained from a fistula established for the purpose in a dog clears many points in the histology of fat necrosis and settles some points in the mechanism of its origin and spread.

The conclusions reached by these investigators were, briefly, as follows:

1. That fat necrosis, as has been previously shown, is due to the contact of the pancreatic juice with the fatty tissue.

* Read before the American Surgical Association, May 29, 1912.

¹ Experimenteller Beitrag. zur Kennt. der Fettgebsnecrose, Berl. klin. Woch., No. 9, 1910, 386-388.

The results of intraperitoneal injection were positive in every case.

2. The focus attacked by the pancreatic juice showed primarily a clear fat necrosis, in which later a reactive inflammation occurs which brings the process to a standstill. Newly formed giant-cells then enter the field, and finally, by the deposition of lime salts, the focus of fat necrosis is converted into a chalk-deposit.

3. A methodical chemical analysis of the fat necrosis showed the presence of a fatty acid, an earthy soap, an alkaline soap, glycerin, peptone, and tryptophane, bound together.

4. It was proven that the uninjured peritoneum exercises a strong protection over the underlying fat, preserving it from the action of the pancreatic juice, and tending to prevent the spread of the necrosis. The factor which leads to the wide dissemination of fat necrosis is most probably to be found in the existence of an accidental or physiological separation of the serous covering.

5. As it was impossible to demonstrate experimentally that fat necrosis is disseminated by way of the blood stream, it was thought most probable by these investigators that its spread was to be explained by regarding the lymphatics as the channels through which extension of the process occurs.

It is interesting to find the results of these experiments corresponding so closely with some of the observed clinical facts. The tendency to spontaneous cure which is evidenced clinically in some mild cases of acute pancreatitis where the diagnosis has been definitely made by an exploratory incision, is thus explained satisfactorily, on the basis of a reactive inflammation set up in the area of the fat necrosis and in the deposit of lime salts as in the spontaneous cure of tuberculosis. If it were possible to detect such cases by means of clinical diagnosis, the waiting policy would of course be clearly indicated. Unfortunately, however, the diagnosis in these acute lesions of the pancreas has not yet reached such a satisfactory stage. In the severer cases, however, with rapid onset and spread of the fat necrosis, it is obvious that the natural processes are in

need of help from the surgeon, who should be able, at least in certain cases, to diminish the tension by efficient operative drainage and so relieve the condition by stopping its further spread, and, in view of the ever present danger of accidental infection from the hollow viscera in the neighborhood, to provide a means for its prevention or its possible relief.

Although it has been shown that fat necrosis is due to the liberation of a fat splitting ferment from the pancreas, either as a result of trauma, hemorrhage, or a surface exudate from the obstruction of its main duct, the reasons for its occurrence in many cases are not always clear. Obstruction of the common pancreatic duct by a stone in the ampulla of Vater forms a satisfying and demonstrable cause in some cases, especially the chronic ones, but in others no such obstruction is found.

The relation of acute alcoholism as a causal factor in cases of acute pancreatitis has been suggested by Moynihan, and in my own case, seems at least probable. By assuming the presence of a gastric or a duodenal ulcer or a catarrhal gastro-duodenitis, we have the basis of obstruction and infection which is apparently necessary to cause the final explosion. The symptomatology of acute pancreatitis is unfortunately not sufficiently characteristic to enable one to make the diagnosis with any degree of certainty, so that it comes to be made, if made at all, by means of the exploratory laparotomy, which by reason of the urgency of the conditions is often called for.

Aside from the problems of diagnosis which are of the utmost importance, the still difficult problem of appropriate treatment is constantly presenting itself.

With all this in view, and from the fact that these cases are after all among the surgical rarities, I have ventured to present to this society the clinical history of a carefully observed case of acute pancreatitis occurring in my hospital service, which presented some unusual features.

CASE REPORT.—John M., age twenty-eight, United States, driver, was admitted to Bellevue Hospital October 26, 1910. His previous history was unimportant, save that he states he had never

suffered from any similar attack, and that he was a confessed alcoholic.

For two days before admission, he says he was intoxicated most of the time. On the evening before his seizure, he ate a hearty meal of a pound and a half of beefsteak, some potato salad, some bread and butter, and coffee. Two hours later he took several drinks and went to bed feeling, as he expressed it, in the best of health. He slept until 2 A.M., when he was awakened by a sharp stabbing pain in the pit of the stomach, for the relief of which he got up, went out to a bar-room in the neighborhood, and drank two glasses of whiskey, which he almost immediately vomited. He had also a very loose movement of the bowels at this time but pain was not relieved, so he went back to bed where he continued to suffer from severe abdominal pains and vomiting until brought to the hospital in the late afternoon. His pain by this time had become more general over the whole abdomen, he had vomited repeatedly, and complained of feeling chilly and feverish and of sweating profusely at times. He was carefully examined on his admission to the medical ward, and the usual examinations of blood and urine were made. His temperature at the time of admission to the hospital was 101.2° , pulse 100, and respirations 28. He looked alcoholic, his face was flushed and he appeared very sick. His abdomen was somewhat tympanitic and tender over the region of the appendix, and especially so above the umbilicus, where the abdominal wall was rounded and very tense.

He had a leucocytosis of 26,800, with a polynuclear percentage of 89 per cent. His urine was of high specific gravity, 1034, with a trace of albumin and bile, a few hyaline and a very few granular casts and white blood-cells. His heart and lungs were negative, and his spleen was not enlarged.

On the day following, there was slight increasing resistance in the upper right abdominal quadrant and dulness in the right flank. There was also some muscular rigidity and tenderness noted over the upper segment of the right rectus. The temperature had risen to 102.8° and the pulse to 120. The case was seen at this time by a surgical colleague, who declined to operate as the condition was not clear. On the next day the temperature dropped to 100° and did not reach 102° again until three days later, the day before operation. Coarse friction developed in the

left lower axilla and the patient complained of pain on deep inspiration, so that developing pneumonia was suspected. There was also some flatness on both sides just below the angle of the scapulæ, and the patient appeared very sick. The blood count remained high as before and showed a polynuclear percentage ranging from 87 to 90. On October 31, five days after admission, a well-defined rounded mass was made out situated chiefly in the mid-epigastric region and reaching down to within a finger's breadth of the umbilicus. The upper limits shaded off into the muscular resistance. The mass was dull on percussion, rather tender, firm, and elastic to the touch, and above it was a well-marked area of tympany. On November 1, the next day, the case was first seen and examined by the writer, and although the definite differential diagnosis of acute pancreatitis was not possible, the condition was suspected and an immediate operation advised and done as soon as preparation could be made.

Operation (Nov. 1, 1910, Dr. Hotchkiss).—Ether anæsthesia. Laparotomy above the umbilicus through the inner fibres of the right rectus muscle was done.

Upon opening the abdomen an enormously thickened omentum which was lightly adherent to the anterior abdominal wall was disclosed. This was very evidently the seat of an extensive fat necrosis which at once established the diagnosis. As the patient's condition was very bad, the gall-bladder was not searched for through the adhesions and its condition was not determined. A finger was thrust through the lesser omentum, which was very thick, and the seat of extensive fat necrosis, and the lesser peritoneal cavity was opened, giving vent to a considerable quantity of bloody fluid under pressure together with numerous lumps of tissue, apparently necrotic fat and fibrin. The pancreas was easily palpated but its exact condition could not be made out any further than to discover that it felt harder in some places than in others. A large cigarette together with a wrapped split drainage tube was carried to the bottom of the lesser sac, the abdominal wound closed to the drains, and the patient returned to bed.

His condition improved somewhat after the operation, the pulse becoming a little less frequent and the temperature tending generally below 101°. The blood count however continued high, appetite failed, and the patient grew steadily weaker and much emaciated. It soon became evident that the anterior drainage

alone was inefficient, and a second operation was advised and done on November 19. At this operation, the anterior sinus was excised and the wound reopened. The patient was turned over on his face, and a broad incision parallel with the twelfth left rib was made, opening into the lesser sac from behind. From the large pieces of necrotic tissue which were washed away it was evident that we had to deal with a very extensive fat necrosis of the retroperitoneal tissues. A large fragment of tissue which was washed from the wound was submitted to the pathologist and found to be a portion of necrotic pancreas. This piece and others resembling it were dry, crumbly, and evidently in a condition of fat necrosis. Through-and-through tube drainage was arranged and the patient who was in considerable shock was returned to bed, where he quickly rallied. The temperature fell but rapidly rose to 104° on the second day and then gradually receded. The drainage was very profuse for the first few days, necessitating frequent change of dressings, and irrigation continued to bring away large amounts of necrosed fatty tissue and purulent fluid.

The discharge soon diminished and the drainage openings contracted rapidly and soon were nearly closed. The patient remained very white, feeble, and emaciated, and all our resources were taxed to provide him with food which could be assimilated. For a time he barely held his own and then his appetite began to return and he began to gain in strength and flesh and color. On December 16, a faintly positive Cammidge reaction was obtained, and the posterior wound had nearly closed. The rubber drainage tubes were removed as early as possible for fear of pressure necrosis. The temperature fell to nearly normal, the pulse had much improved in quality, and the anæmia was less apparent. On December 21, however, just as his improvement had become well established and he was eating well and enjoying his food, he had a sudden profuse discharge of fluid from the anterior sinus, which was found to contain most of his recent meal. The diagnosis of stomach perforation was confirmed by allowing the patient to drink water tinged with methylene blue, which almost immediately flowed out of the wound sinus. The patient's strength began to fail very rapidly and it became evident if he were to be rescued from starvation an attempt would have to be made to find and close the opening in the stomach.

Accordingly six days later, on December 27, the patient was

taken to the operating room for the third time and his abdomen again opened under ether anæsthesia. As the attempt was extremely hazardous in his very weak condition, he was first infused with saline solution. His abdomen was painted with tincture of iodine and the track of the original anterior incision together with the sinus was excised. On exploring the anterior wall of the stomach no perforation could be seen and as the organ was adherent lightly along the greater curvature, and as much handling of the viscera was out of the question in the patient's feeble condition, an incision was rapidly made through the anterior wall of the stomach and a small perforation quickly discovered upon the posterior wall, just above the greater curvature. The adhesions along the greater curvature were easily broken up and with one finger in the cavity of the stomach the perforation was easily pushed forward into the wound, where it was quickly surrounded with a purse-string suture, dropped back, and the incision in the stomach closed, with the loss of but little time. The abdominal wound was closed to a small cigarette drain and the patient put back to bed in a condition of severe shock, from which, however, he quickly rallied. A period of careful rectal feeding followed and after a week, careful stomach feeding was resumed. The patient gained very rapidly in flesh and strength and went on to an uncomplicated and apparently perfect recovery. He reported several months after his discharge from the hospital, showing an enormous gain in weight and being apparently in perfect health.

The question which naturally arises with respect to the late perforation of the stomach, as to whether it was due to pressure necrosis or to pancreatic digestion of a damaged portion of the stomach wall, or to the pre-existence of a gastric ulcer, can of course not be answered.

ACUTE DIVERTICULITIS OF THE SIGMOID FLEXURE OF THE COLON.*

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At the 1907 meeting of the American Surgical Association, W. J. Mayo and George E. Brewer presented the subject of diverticulitis of the sigmoid, the former discussing the affection from the stand-point of chronic thickening simulating carcinoma, the latter from that of left-sided suppuration simulating appendicitis. So important were these communications that Fitz, of Boston, taking part in the discussion by invitation, said that, "They made a fairly complete picture of what must be recognized as a new disease of the lower abdomen: diverticulitis of the left quadrant analogous to appendicitis of the right quadrant." So far as I am able to learn these were the first clear pictures which had been drawn. Pathologists had recognized inflammatory affections of the sigmoid in the course of their post-mortem examinations, but clinicians were lacking in appreciation of the importance of the conditions.

A number of communications have been made on this subject since the appearance of these important papers by Mayo and Brewer. Notable among these are those of:

Telling (*The Lancet*, vol. i, 1908; *The Proctologist*, March, 1911), Anschütz (*Centr. f. Chir.*, 1909, p. 1176), Moure et Desbouis (*La Presse Méd.*, No. 104, 1909), Hartwell and Cecil (*Am. J. Med. Sci.*, vol. cxi, 1910), Dunn and Woolley (*Am. J. Med. Sci.*, vol. cxlii, 1911), Bruce (*ANNALS OF SURGERY*, May, 1911), Erdmann (*Yale Med. Monthly*, Feb., 1912), Cameron and Rippmann (*Guy's Hospital Reports*, vol. lxiv, 1910), Zengerle (*Centr. f. Chir.*, 1912, p. 275), Barbat (*Surg., Gynæcol., and Obstet.*, March, 1910), Franke

* Read before the American Surgical Association, May 30, 1912.

(*Deutsche med. Woch.*, No. 3, 1909), Neupert (*Arch. f. klin. Chir.*, vol. lxxxvii, 1908), Wilson (*ANNALS OF SURGERY*, Feb. 1911), Chiari (*Centr. f. Allgem. Path.*, vol. xxii, 1911), Eibegger (*Prager med. Woch.*, No. 43, 1910), Verdenal (*Thèse de Lyon*, 1907). Some of these, especially the papers written by Telling and by Hartwell and Cecil, are analytical and exhaustive,¹ others present in detail the histories of carefully observed cases. The pathological condition is a definite one² and must be borne in mind by clinicians when considering affections of the left lower quadrant of the abdomen. These diverticula are of the variety known as false, they are acquired, they are more often found in males than in females, and they are particularly observed in obese individuals at or near mid-life who have suffered from flatulency and constipation. My belief that acute diverticulitis occurring in these obese people is a grave condition leads me to report the following illustrative case:

CASE I.—Mr. B., age forty-nine years, unmarried. Height 5 feet 9½ inches, weight 240 pounds. Chronic bronchitis for many years, “ailing” off and on for many years. History of acute appendicitis 17 years ago. Right oblique inguinal hernia for the past six years, this controlled by a truss. No definite kidney history. The bowels have at times been loose, at times markedly constipated. Patient very obese, full reddish face. He has been a very heavy eater and has taken practically no exercise.³

Present Illness.—November 15, 1911: “Bilious.” Bowels emptied thoroughly by compound cathartic pills, these repeated two nights. Free, large movements.

November 18: Felt rather badly. Nine or 10 bowel movements.

November 19: Seen by Dr. C. E. Edson. The urine was

¹ An excellent bibliography accompanies the paper of Barbat.

² While this communication considers only diverticulitis of the sigmoid, the most frequent seat of diverticula, it is to be borne in mind that intestinal pouches, both false and true, are met with in other portions of the large intestine and throughout the length of the small intestine.

³ I have known him intimately for 17 years and he has always impressed me as being a very poor surgical risk.—C. A. P.

normal. Patient complained of soreness at and above the left groin and of discomfort over the lower part of the descending colon. He was tender on pressure at the sigmoid region on the left side. The pulse and temperature were normal.

November 20: The patient said that he had pain in the lower abdomen throughout the night. Since then he had been on the verge of chilliness. He had had no bowel movements since 5 o'clock of the previous afternoon. At 4 P.M. the temperature was 101.5° , the pulse 90. Pain and tenderness over the lower left quadrant of the abdomen. At 6 P.M. (November 20) he was seen by me in consultation with Dr. Edson. *Notes:* The temperature was 101° , the pulse 90. There had been no vomiting; the patient was in bed; his facial expression was fairly good, he complained of moderate pain in the lower left quadrant of the abdomen. He has had no definite urgency of urination, he has had no rectal tenesmus. There has been no blood in the stools, there has been no rectal discharge. *Physical examination:* The abdomen showed no distention on inspection. It was very full, through fat, but did not impress me as being distended. There was an exquisitely tender area the size of the palm of the hand midway between the navel and the left anterior superior spine. This area was very tender on even light pressure. The abdomen at this point was very rigid; the remainder of the abdomen was free from rigidity. Deep pressure in the region of the appendix elicited a little tenderness but this was not at all marked. Nothing was found in the region of the stomach or liver. Digital rectal examination showed a somewhat enlarged prostate, it elicited no tenderness, and met with no resistance. The right testis seemed normal, the left testis was not to be felt. The patient was immediately sent to the hospital and a blood count ordered; this showed a leucocytosis of 26,000 and a differential of 77 per cent.

Note.—This man impressed me as having a definite and urgent surgical affection of his left lower quadrant. He was exquisitely tender and quite rigid, he had a moderate fever, he had a high leucocytosis. Despite the fact that I believed him to be a very unfavorable surgical risk I felt that his abdomen should be explored. He may have had an acute diverticulitis,⁴ a badly

⁴I do not feel that one should say that a pre-operative diagnosis of acute sigmoid diverticulitis was made in this case; the condition was simply thought probable.

placed appendix, a thrombosis with intestinal gangrene. The condition may have been one of many things, but I believed it to be surgical.

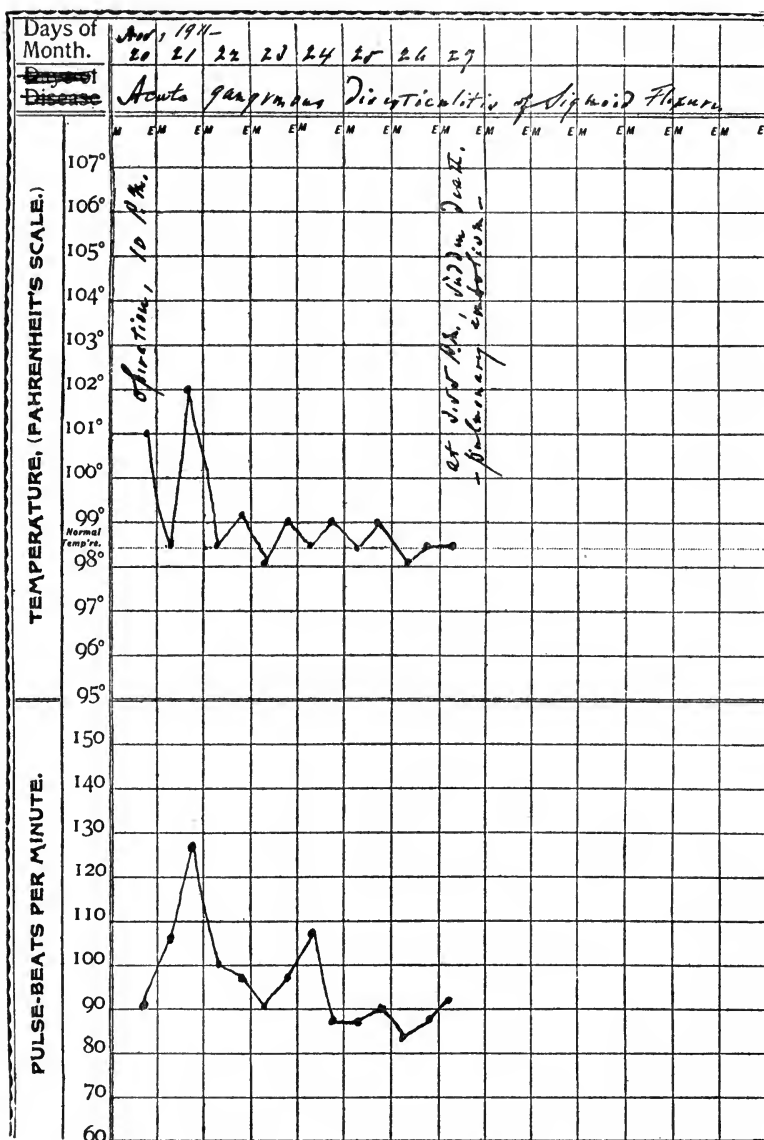
*Operation*⁵ (at St. Luke's Hospital, 10 P.M., November 20).—Ordinary iodine preparation. Patient in moderate Trendelenburg position. Long, free incision in median line from pubes to above umbilicus. Abdominal wall very thick, the preperitoneal fat being at least three inches in thickness. Intestines moderately distended but of good color. No evidence of peritonitis. Under wide retraction and thorough packing off of the small intestine a gangrenous mass about the size of an apple was found at the middle sigmoid. This mass was of a dark greenish, yellowish color. The sigmoid was bound down and not capable of being brought up. Careful examination showed the mass to contain a gangrenous diverticulum about the size of an olive. This was at the upper part of the mass and at the convex border of the sigmoid; the rest of the mass was apparently made up of fat. Speedy decision made to attempt the removal of the mass from the sigmoid. (Excision of this area of the sigmoid with an anastomosis would have been fraught with the utmost possible difficulty.) Mass grasped with left hand and gently drawn up; at this time the diverticulum ruptured at its upper part, and feces were extravasated on protecting gauze packs. Rapid knife dissection of the mass away from the gut, beginning below; fairly sharp bleeding; diverticulum proper cut away from the gut, leaving a hole in the intestine about the size of a penny. Wall of sigmoid thickened and friable. The best possible closure of the intestinal opening was made with plain catgut and chromic catgut and the best possible attempt was made to cover this area with adjacent epiploic fat. Closure not thoroughly satisfactory, owing to the friable condition of the entire segment of the sigmoid, but considered pretty satisfactory; indeed, as satisfactory as I was able to make it.⁶ (The possibility of a fecal fistula was borne in mind.) Free incision through left flank with introduction of drain to seat of wound in sigmoid. Small tube above bladder to bottom of pelvis. Ordinary cleansing. (Ab-

⁵I am indebted to Drs. Edson, W. S. Bagot, and S. Fosdick Jones for helpful advice and assistance.

⁶No other diverticula were observed, but prolonged search was not made.

dominal left testis discovered.) Suture of abdominal wound. Time of operation something over one hour; condition of patient good at close, pulse about 100.

FIG. 1.



During the three days following operation the course was rather stormy. The urine showed a heavy ring of albumin and granular casts. Both lungs showed fine and coarse râles. There was no vomiting, and while the intestinal distention was marked, yet it was possible to relieve gas in a fair degree. Five days after operation the condition seemed very satisfactory. The temperature was normal, the pulse was 94 to the minute and of excellent quality. The patient was passing gas freely, the facial expression was good, the subjective symptoms were good. On this day a fair-sized liquid bowel movement contained a moderate amount of bright and dark blood; this appearance of blood did not recur. On November 27, seven days after operation, the temperature was normal, the pulse averaged 90 to the minute, the patient was comfortable; he was sleeping well and passing a large amount of gas. His recovery seemed assured (see clinical chart). I saw him at 2 P.M., at which time his condition was in all ways good; he was entirely comfortable. At 2.45 P.M., he suddenly complained of excruciating thoracic pain and became ashen in color, gasping for breath. The pulse, as taken by the nurse, was very weak and irregular, almost imperceptible. I reached him a few moments later, at which time he presented the typical picture of pulmonary embolism. He was hardly conscious, he failed steadily, and died at 3.55 P.M., one hour and ten minutes after his first thoracic symptom.

An examination of the abdomen was made four hours after death. There was no peritonitis, the sutured area at the sigmoid was intact. There was a moderate plastic exudate at the site of suture. The chest was not examined, as the symptoms of pulmonary embolism were classical.

We have in this case an acute gangrenous diverticulitis of the sigmoid, in which operation was done at a comparatively early hour, certainly before rupture or peritonitis had occurred. The gangrenous area was excised and the opening in the sigmoid sutured. The patient was apparently making a good recovery when he suddenly succumbed to pulmonary embolus on the seventh day. When the abdomen was examined after death it was found to be clean.

It is not easy to positively segregate the reported instances

of the acute form of diverticulitis; some overlapping must necessarily occur. I am able to collect from literature hardly more than a dozen cases submitted to operation (Cameron and Rippmann, Brewer, Mertens, Wernecke, Erdmann, Barbat, Bruce, Hartwell and Cecil); of these, almost all which were attended by perforative peritonitis died, while of those in which an abscess was opened and drained almost all recovered. I am unable to find the analogue of the case reported in detail in this communication, although it is more than probable that such exists. Certainly the danger of perforation in acute diverticulitis is grave⁷ and this renders early diagnosis⁸ and prompt operative interference of great importance. While the condition is analogous to appendicitis, the operative management is less simple than is that of the acute inflammations of the appendix, and it is with this thought in mind that I venture to bring the subject through with but a single illustrative case, before the Association.

⁷ A large proportion of the literature of the subject is based on autopsy findings.

⁸ The symptoms are practically those of an acute appendicitis of the left side. Telling (*loc. cit.*) gives an excellent résumé of the occurrence, pathology, and forms of diverticulitis.

HEMORRHAGE INTO THE PERITONEAL CAVITY CAUSED BY ACCIDENTAL RUPTURE OF THE OVARY.*

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As the result of a severe strain a blood cyst of the ovary may rupture and cause serious or even fatal hemorrhage into the peritoneal cavity. After careful consideration of the two cases recorded in this paper, together with a study of the literature of intraperitoneal hemorrhage of ovarian origin, one must inevitably conclude that such an accident is not only possible but that in all probability it is of much more common occurrence than we imagine.

The most common cause of intraperitoneal hemorrhage in women is dependent upon an extra-uterine gestation. It is no doubt true, as has been suggested by some writers, that the possibility of other etiological factors being active in its production has been overlooked, because in an enormously large percentage of cases a ruptured ectopic pregnancy is found to be the source of the bleeding. An analogy exists in the confident fashion in which surgeons diagnose appendicitis whenever localized peritonitis manifests itself in the right iliac fossa. In the vast majority of instances such conclusions are correct, but with wide experience we are led to believe that, as a fact, an absolutely assured diagnosis of acute appendicitis is rarely possible.

In this paper we are not concerned with a ruptured ectopic pregnancy as a cause of intraperitoneal hemorrhage, excepting perhaps to be reminded of the indirect effect of an extra-uterine gestation in causing a congestion of the ovary, which may in

* Read before the American Surgical Association, May 29, 1912.

turn lead to the production of hemorrhagic cysts, and these may rupture. This fact should be borne in mind by the operating surgeon; both ovaries should be carefully examined during the operation, else a fatal error might be made in failing to check hemorrhage from an ovary which is in no way connected with the gestation sac.

The cases which I now record were not connected with pregnancy. In both instances what appeared to be a normal Graafian follicle had ruptured as the result of an accidental strain. In one instance the patient lifted a heavy weight and the rupture immediately occurred. In the other case the patient had a violent attack of vomiting in the early stage of an acute appendicitis and this brought about a similar result. In both instances serious hemorrhage occurred into the peritoneal cavity and almost proved fatal in one of my patients. The histories are as follows:

CASE I.—Profuse hemorrhage from the accidental rupture of a Graafian follicle into the peritoneal cavity. The rupture was caused by a strain while lifting a heavy weight. Operation. Recovery.

Mrs. R., age thirty-five, was the mother of twin boys three and a half years old. There had been no other pregnancy. The menstrual history was normal. Two days before her period was due, at eight o'clock in the morning, while attempting to lift a heavy chest she experienced sudden severe pain in the lower part of the abdomen. She became nauseated and had frequent attacks of vomiting during the day with continuance of the pain. Twelve hours after the onset of her trouble she was seen in consultation. She was very anæmic, her face bore a pinched and anxious expression. Her temperature was 97.6° F. and her pulse 130. There was marked abdominal distention with a wall uniformly rigid. Palpation at once induced vomiting. There was general tenderness, but this was most marked in the left iliac and hypogastric regions. *Per vaginam* a mass was felt which crowded the uterus down and fixed it firmly. Pressure on this mass induced great pain. On opening the abdomen a very large quantity of blood was found free in the peritoneal cavity. This was fluid in the upper part of the abdomen, but in the pelvis and about the

uterus it was clotted. The clot showed some tendency to adhesiveness, sufficient to account for the fixation of the uterus. The left ovary was somewhat larger than normal, and upon its upper free border existed a ruptured hemorrhagic cyst the size of a hazel-nut. Arterial blood was spurting in a pulsatile fashion from a definite point. The ovary and tube were removed together with much of the clots and fluid blood. The right ovary and tube were normal.

The patient made an excellent recovery, but for the first ten days an evening temperature of about 100° F. was noted. This doubtless was due to the peritonitis which is more or less an invariable accompaniment of hemorrhage in this locality.

The pathologist reported that the specimen in the gross showed a corpus luteum ($2\frac{1}{2} \times 2$ cm.) with evidence of recent rupture. There was no pregnancy.

CASE II.—Hemorrhage into the peritoneal cavity due to a ruptured Graafian follicle complicating an attack of acute appendicitis. The rupture was caused by strain induced by a violent attack of vomiting.

The patient was forty years of age, married, and an exceptionally active woman. A few years previously she had a small cystic adenoma removed from the breast. She has had occasional attacks of indigestion characterized by flatulence and abdominal distress, and there has been a tendency to constipation. The menstrual history was normal, and her present attack developed two days before a period was due. She had never been pregnant.

At two o'clock in the morning she wakened with acute pain in the abdomen. She had been at the theatre the night before, and on her return home had felt some distress and unrest in the abdomen but no definite symptoms of local trouble. In the morning her physician found her with a normal pulse and temperature and complaining of some tenderness over the lower part of the abdomen. An enema at 10 A.M. was followed by a violent attack of vomiting, which left her very sore and with definite tenderness in the right iliac region. At 6 P.M., in consultation, one found acute pain on pressure over the appendix region with slight but marked local rigidity. The pulse was 80 and the temperature normal. She had no nausea. A diagnosis of appendicitis was made.

Operation was performed at 10 P.M., 20 hours after the first appearance of symptoms and 12 hours after the violent attack of

vomiting. The moment the peritoneum was opened in the appendix region fluid blood welled up in the wound in large quantity. Toward the pelvis some dark clots were found. An incision was now made in the middle line and a large quantity of dark blood-clot was found filling the pelvis. The left ovary and tube were normal. The right ovary was considerably enlarged, and a cyst about the size of a hazel-nut was ruptured on its anterior aspect. Adherent to this was a blood-clot. It was quite obvious that the ruptured Graafian follicle was the source of the hemorrhage. The ovary and tube were removed. Attention was now turned to the appendix, and through the primary incision in the right iliac region one removed that organ, which was acutely inflamed and adherent. The pathologist made the following report on the material removed:

"The specimen received consists of appendix, ovary, and distal portion of the tube. The ovary is enlarged and ruptured on its anterior aspect. Adherent to the ruptured portion is a fairly large amount of clotted blood. Microscopical examination: The appendix shows acute inflammation in the mucosa and also an acute peri-appendicitis, as evidenced by the presence of fibrin and pus on its peritoneal surface. Sections through the ovary show the remains of a Graafian follicle which has ruptured into the peritoneal cavity and from which hemorrhage has taken place. There is no evidence of pregnancy or malignancy."

The sequence of events in this case is quite obvious. The patient had an attack of acute appendicitis two days before her monthly period was due, and a violent attack of vomiting had brought about rupture of a Graafian follicle. The hemorrhage into the peritoneal cavity had been slow and had shown no symptoms, but was only discovered when the abdomen was opened for the removal of the appendix 12 hours afterward. Had the patient been left until morning she not only would have run considerable risk from an attack of acute suppurative appendicitis, but she might have lost her life from hemorrhage.

These two cases have some points in common. Thus an accidental strain caused rupture of an ovarian blood cyst and induced the hemorrhage. In both the Graafian follicle was ruptured two days before a menstrual period was due. In each

instance one observed that the extravasated blood was clotted in the pelvis and had remained fluid in the upper part of the peritoneal cavity. This last observation may bear some relationship to the circumstance that the pelvic and lower abdominal zone of peritoneum shows greater resistance to septic trouble than the upper regions of the peritoneum. The local conditions which lead to a higher degree of resistance may likewise favor clotting and induce the tendency to adhesiveness which on the one hand in the presence of effused blood leads to the production of the so-called pelvic hæmatocele and on the other hand by the production of adhesions may produce a localized abscess well walled off from the general cavity. Pus like blood is more likely to become diffused and to remain free in the upper zones of the abdomen and more likely to be limited by adhesions in the pelvis and in the lower abdominal zones.

Jayle, in his paper on retro-uterine hæmatocele caused by the rupture of a blood cyst of the ovary, is very emphatic in his opposition to the usual teaching regarding the etiology of pelvic hæmatocele, for example, he calls attention to the fact that Pozzi in his treatise on gynæcology makes a statement, printed in italics, intended as an aphorism for the guidance of practitioners which reads as follows: "*L'hématocèle enkystée est un accident de la grossesse ectopique.*" In English text-books likewise, little attention is paid to this very important subject. The frequency with which an ectopic pregnancy is found to be the source of the bleeding has so impressed the various writers of such works that they treat this aspect of the subject in an exhaustive fashion but give scant attention to the possibility of rupture of an ovary causing hemorrhage in the absence of pregnancy. The writer in Kelly and Noble's treatise on gynæcology and abdominal surgery makes no mention of free hemorrhage into the peritoneal cavity. He says that "a pelvic hæmatocele is formed of an effusion of blood into the peritoneal cavity which subsequently becomes incapsuled. In the great majority of cases the condition results from tubal pregnancy . . . other causes of pelvic hæmatocele rarely

exist." Webster dismisses the subject by saying that occasionally an effusion of blood may be brought about during menstruation usually from sudden strain, and mentions the fact that this may occur with the rupture of a Graafian follicle. Hermann enumerates the causes of great hemorrhage into the peritoneal cavity as (1) rupture of a pregnant Fallopian tube; (2) rupture of a varicose vein; (3) rupture of an ovary; (4) rupture of the gravid uterus. He makes the following interesting statement: "There is a physiological bleeding, not enough to give trouble, into the Graafian follicle with ovulation. It has been supposed that this physiological congestion may, by accidental causes acting shortly before the time of ovulation, be so increased that the bursting of a Graafian follicle will cause bleeding enough to form a hæmatocele. This is theory; there is no evidence that a healthy ovary ever bleeds enough to form a hæmatocele." Hermann, however, states that when a blood cyst forms pathologically in an ovary it may assume large proportions and the hemorrhage from this may be sufficient to kill the patient.

The possibility of serious hemorrhage occurring from rupture of a Graafian follicle was recognized as far back as 1851 by Nélaton, by Rokitansky in 1855, and by Puech in 1858. The last author applied the term "apoplexy of the ovary" to the rupture of a Graafian follicle, which he says may cause fatal hemorrhage into the peritoneal cavity. It has been suggested that these older writers did not recognize ectopic pregnancy, which it is claimed must have been a cause which was overlooked in many of their cases. It is true that no very special attention was given to extra-uterine pregnancy until 1883 when Lawson Tait first operated for its relief, and there can be no doubt that many cases described as hemorrhage of ovarian or tubal origin were really those of ectopic gestation. But some of the more minute details are given in certain cases by these older authors, which seem to show beyond doubt that they had cases of serious hemorrhage from ruptured ovaries in the absence of pregnancy.

The writer wishes to urge that more attention should be

given to accidental hemorrhage from the ovary such as is illustrated by the two cases herein recorded. The condition is probably not extremely rare; thus one finds numerous instances in searching the literature. For example, Wilson reports eight cases of hæmatoma of the ovary occurring in the clinic at St. Bartholomew's Hospital; Holmes records two cases of pelvic hæmatoma of ovarian origin; Hind reports a case of a very large intraperitoneal extravasation of blood from rupture of a Graafian follicle of the left ovary. The patient recovered after operation. Penny describes a somewhat similar case of hemorrhage from the right ovary; Lockyer records three cases of extensive intraperitoneal hemorrhage of ovarian origin; For-dyce reports two fatal cases of peritonitis following menstrual suppression, in one of which the bleeding, which had come from a cyst in the right ovary, had led to the formation of an encysted hæmatocele which suppurated. Jayle reports 17 cases, three under his own care and 14 from the literature. In two of these a blood cyst was ruptured during examination under an anæsthetic. Doran reports a case of hemorrhage into an ovarian cyst due to torsion of its pedicle.

The tendency to development of blood cysts of the ovaries in a bilateral fashion is quite striking, so much so that our judgment must be markedly influenced by the circumstance. Jayle called attention to this fact, and in one of his cases, where he had operated for hemorrhage from a ruptured cyst of the ovary on one side, the symptoms recurred some months after and he had to remove the other ovary for a similar condition. He advocates double oöphorectomy when called upon to operate, particularly in women no longer young. This suggestion of bilateral development implies a pathological condition of the implicated ovaries. Jayle considers this to consist of hypertrophy and exaggerated development of the ovarian capillaries. The rupture of such bilateral hemorrhagic cysts is also described by Hedley, Lockyer, and by Giles.

A number of cases are on record where an error of diagnosis has been made because the condition present simulated acute appendicitis. Two of the cases reported by Lockyer were

examples of this and were operated on by Mr. Stanley Boyd; in each a hæmatocoele was present but the appendix was normal. Wilson also mentions this error in diagnosis and in addition an instance where the diagnosis of perforated gastric or duodenal ulcer was made. The local signs of trouble in the right iliac fossa, with vomiting and elevation of pulse and temperature, may so simulate acute appendicitis as to make a positive opinion impossible. The diagnosis too from a ruptured ectopic gestation cannot always be made until the abdomen is opened or the implicated organs carefully examined in the laboratory. Again these two conditions may co-exist.

As far as I am aware the second case recorded in this paper is the only one in the literature where an acute septic appendicitis was complicated by serious intraperitoneal hemorrhage from the accidental rupture of a Graafian follicle. It suggests to the writer that possibly some of the instances of fatal peritonitis reported, in which the rupture of a blood cyst of the ovary was looked upon as the primary cause, really had their origin in an acute appendicitis or some such analogous septic condition, and that the rupture of the ovary was an accidental accompaniment due to strain, with something like the sequence of events described in my case. This view is further strengthened by the fact that in some instances the amount of blood effused was extremely small, and the authors have expressed surprise that such a small quantity of blood should have produced such grave results.

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TUBERCULOSIS OF THE BLADDER, URETER, AND KIDNEY.*

REPORT OF CASES

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I HAVE always been under the impression that tuberculosis of the kidney, ureter, and bladder was a rare occurrence, and that the number of such infections was small. When very recently I found that I had six such cases under observation at the same time, I came to the conclusion that it was more than a coincidence. As I look back at my early surgical experience, I realize that many of these cases have been missed. They come to the physician, not for disease of the kidneys or for pain in the back, bloating, or other such symptoms usually ascribed to the kidneys, but on account of persistent bladder distress, frequent, and painful urination. Almost without exception this is the first, as it is the most important, danger signal in this class of cases. Occasionally these people will have passed small quantities of blood in the urine; usually the blood will be small in amount, but there may be times when there will be enough blood passed, to make one think of bladder tumor or kidney stone. As Newman says, "Hæmaturia is almost as certain a sign of tubercular kidney, as hæmoptosis is of pulmonary phthisis." The plan which we have all been accustomed to follow in these cases has been to make a diagnosis of cystitis, give some prescription which would correct the over-acidity or alkalinity of the urine, and usually to give urotropine in an empirical way; later when the patient did not improve, we have used some form of bladder irrigation, changing the solution or its strength, vainly trying to find something which would help these people. Washing out the excess of pus from the

* Read by title before the American Surgical Association, May, 1912.

bladder combined with the "faith cure" would make these people believe for a time that they were better. But Braasch is undoubtedly correct when he says that "no one is justified to-day in treating locally a case of bladder irritability until all means have been exhausted to exclude the existence of renal tuberculosis." When tuberculosis of the bladder is proven we may then safely conclude that over 90 per cent. of such cases are secondary to some form of inflammation in one kidney if in the early stages of the disease, or in both kidneys if seen late in the progress of renal tuberculosis. Primary bladder tuberculosis is extremely rare, according to Kummell of Hamburg, who is one of the best authorities on the subject. Infections of the bladder from a primary tuberculosis of the testicle, where the infection has ascended along the vas deferens to the seminal vesicle and then to the prostate, is extremely rare.

Kummell also states that when in such a case the bladder is involved, it usually means that there is a separate focus in one kidney, quite separate from the genito-urinary tuberculosis.

I have been very much interested of late in looking up the subject of renal tuberculosis from the medical side, for the reason that I have recently heard that the best internal medical men of the country did not believe that tubercular nephritis was often surgical, but should usually be treated with tuberculin and the fresh-air cure, consequently I turned to the standard authorities on internal medicine.

I find that Osler in his last edition turns the discussion of this subject over to J. Tilden Brown, formerly the genito-urinary surgeon at the Presbyterian Hospital, New York. The same is true of Allbut and Rolleston's "System of Medicine" of 1910. Here Sir Henry Morris the English surgeon is the one who wrote upon tubercular nephritis; consequently both these authorities agree with the modern surgical teaching. But the most surprising to me was the conclusions of Wagener of Leipsic, given by my colleague, Dr. Chas. L. Greene. He says that the spontaneous healing of a badly infected tubercular kidney was very rare and that tuberculin has only exceptionally brought about healing. He not only advises removal of a

badly diseased kidney, but also says that he has found that other tubercular foci have been healed after nephrectomy, the other kidney of course being healthy. As he says, tubercular apices of lungs, tuberculosis of bones and joints, tuberculosis of testicle and seminal vesicles have healed, and such complications are in no way contraindication to the operation.

So I find that my informant was not correct, and that the best internal medical men take the same position that the surgeons do. Now when are these cases medical and not surgical? The very early cases of tubercular nephritis in children, when properly taken care of, do recover, as for instance in Case I reported in this paper.

In cases where both kidneys are badly infected or when only one kidney exists, the other having been destroyed by the disease, also after nephrectomy, these patients should always be instructed to keep under medical observation, and especially when the cystitis does not clear up. We all know that Kroeneline is correct when he says: "Removal of a tubercular kidney does not always cure the tubercular cystitis."

This is the class of cases in which tuberculin combined with nitrate of silver injections from 1:2000 up to 1:1000 should be used. I have seen some very satisfactory results lately by the use of this combination.

The diagnosis of tubercular nephritis is made by finding tubercle bacilli in the urine. As Armstrong of Montreal says, we must have pus as well as tubercle bacilli in acid urine, because occasionally in pulmonary tuberculosis tubercle bacilli without pus may be found, while at autopsy no disease of the kidney exists to explain its presence. It is often difficult or even impossible to find tubercle bacilli in a single small specimen of urine, but if all the urine passed in 24 hours is first sedimentated and then stained, tubercle bacilli can usually be found if present, and, on the other hand, if this is done and no tubercle bacilli are found, we can rule out tubercular nephritis with almost absolute certainty. Tubercle bacilli are very much more apt to be found in the urine either with or just after the passage of blood according to Tilden Brown, or

in the urine containing thick purulent particles according to Newman.

The teaching of a couple of years ago that tubercular nephritis could be diagnosed with certainty from the gross appearance of the ureter openings as seen through the cystoscope is now disproved. When the ureteral orifice is ulcerated, showing miliary tubercles on its edges, or assumes the golf-hole appearance, we can usually presume that this is a markedly diseased kidney. But occasionally the ulceration is not about the ureter and may even be on the opposite side of the bladder, so that the only sure and safe method is to catheterize both ureters, which although sometimes difficult is usually possible, and then stain the sedimental from both specimens.

In regard to the catheterization of the ureters, the bladder is occasionally so ulcerated and inflamed that the ureteral openings cannot be seen at all. In such a case recently at the University Hospital (Case VII of the list), my assistant, Dr. Strackhauer, had to make several injections of 1:1000 nitrate of silver solution. At the end of two weeks the bladder inflammation had sufficiently subsided to allow catheterization of the ureters. Such a preliminary course of treatment seems to assure a quicker cure of the cystitis after operation. The hypodermic injection of methylene blue, which Dr. Strackhauer used on this case, noting through the cystoscope the length of time which it takes to be excreted (five minutes in a healthy kidney, 10 to 15 in a diseased one), and the stream not being a bright blue but more muddy in character, proved to be a marked help in deciding the point of function by this diseased kidney.

Kummell makes a strong plea for the examination of the freezing point of blood in these cases. The normal freezing point is 0.56 to 0.57. If the freezing point is 0.6, nephrectomy ought not to be done; but instead we should open and explore the kidney, letting out the pus and removing the worst of the disease. Then tampon the divided kidney with gauze. After a few days the other or better of the two kidneys may improve enough to take up the bulk of the work. We will usually find

that the freezing point of blood has come back to normal, and then it will be safe to remove the diseased or divided kidney.

Nature occasionally cures one of these badly diseased kidneys by stricturing its ureter and shutting it up within itself, autonephrectomy as it has been called. These patients are seldom well. They are more or less uncomfortable, having indefinite abdominal pains and occasionally some bladder distress, from a slight leakage, no doubt, from the partially closed ureter.

Several years ago, before we were able to use the male cystoscope, a physician friend of mine brought me his brother, who was supposed to be suffering from left kidney stone. We had no male cystoscope nor X-ray machine capable of taking a kidney stone picture, as he had suffered from several marked attacks of left kidney colic, associated with the passage of blood with the urine, the abdomen was opened for the purpose of determining the presence of the right kidney. This seemed to be of normal size and consistency. The left kidney was opened; a good sized tubercular abscess filled the upper pole with a smaller abscess in the lower pole. There were also several cheesy masses ready to break down and many miliary tubercles scattered all through the organ. A resection did not seem advisable, so the left kidney was removed. This man lived ten days, only passing two ounces of watery, pusy, thin fluid in all of that time, and the autopsy showed that the right kidney was a solid cheesy mass, with practically no kidney tissue left. Fig. 1 shows the photograph of both kidneys.

The kidney, pelvis, and ureters are often found very much diseased, the ureter being sometimes as thick as the index-finger from tubercular induration. It has been my custom for several years to remove the ureter down to the pelvic brim, according to the advice of Howard Kelly. In a recent case at the University Hospital (Case VII), there was a slow chronic abscess which persisted about the stump of the ureter and eventually wore the poor woman out, over two months after her nephrectomy and long after the wicked tubercular cystitis had disappeared. Since this experience I have adopted Mayo's plan of injecting the stump of the ureter with 20 drops of pure

FIG. 1.



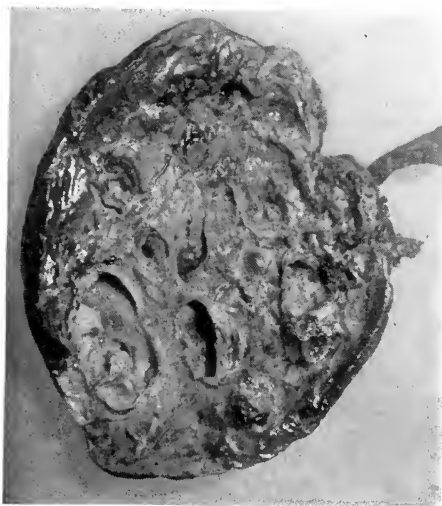
The upper specimen is of the left kidney showing cavities of tubercular abscesses opening into the pelvis. The lower specimen is of the diseased kidney removed at post-mortem. Most of the cheesy masses have been removed but there was no normal kidney substance left.

FIG. 2.



Case III.

FIG. 3.



Case VI.

FIG. 4.



Case VIII.



carbolic acid, ligating and dropping the ureter into the wound.

In regard to the operation itself, we have found that Mayo's incision, especially for the left kidney, helped very much in exposing the high lying kidney and its pedicle, and that the curved kidney clamps of Styles help to prevent the slipping of the pedicle, with its startling and tremendous hemorrhage which sometimes occurs. If the ligature should slip or the clamp not hold the renal artery, the hand is the best tampon. One can feel the pulsating artery very distinctly, and with the finger, if necessary, by the sense of feeling alone can seize the artery with forceps and then easily ligate it with heavy catgut. The renal vein should be separated from the artery and ligated by itself. The ureter should never be ligated in a mass with the vessels, as this predisposes to secondary hemorrhage.

CASE I.—A boy of ten years came to my service at the University Hospital last March with frequent and painful urination, having to urinate every 15 minutes. This symptom was first noted last September. He was put to bed for two months; became worse as soon as he commenced to be about again; soon had pain at the end of urination and nocturnal incontinence. Two weeks before coming to the hospital, first noticed blood in the urine.

Pathology.—Examination of the urine showed a large number of tubercle bacilli. Cystoscopic examination, by Drs. Strackhauer and Ritchie, showed marked ulceration about both ureteral openings with discharge of turbid urine from both ureters. The catheterized specimens showed abundant albumin, pus, and tubercle bacilli; occasional red blood-cells; no casts. Hæmoglobin was 75 per cent.; leucocytes 7300; differential count 50 per cent.; lymphocytes 38.4; polymorphonuclears, 6.8 per cent. large morphonuclears. Temperature occasionally ran 99.2° in the afternoons and pulse occasionally to 120. This boy did not look tubercular, but was of good color and robust in appearance.

No operation was done, but he was turned over to the medical service and is markedly improved in every way, although he still has some bladder disturbance. The tubercle bacilli in his urine have markedly decreased.

CASE II.—(To prove how perfectly these people may recover

after the removal of a badly diseased kidney.) (Surgical case No. 1914.) Mrs. W. L., case of Dr. McKay, Bottineau, North Dakota, age twenty-seven years; married one year; never pregnant; urine thick for two years; pain in back and commenced to fail two years ago; first noticed lump in left side five weeks ago; tubercle bacilli found in urine December 7, 1903.

Pathology.—Tuberculosis with destruction of almost entire left kidney; one ounce of thick, cheesy, offensive pus; cheesy nodules in parenchyma; no apparent disease of the ureter.

Operation.—Exploratory laparotomy showed a few old omental adhesions; right kidney normal; uterus and appendages normal; nephrectomy; difficult removal of large kidney; ruptured during removal.

Result.—Recovered. January 28, 1904, gained 29 pounds. May 15, 1904, weight 125 pounds. October 20, 1904, pus in urine, many tubercle bacilli. December 9, 1905, looks and feels well; two months' pregnant. Baby born safely June 24, 1909. December 29, 1909, mother and baby well. Mother and child still well.

CASE III (Surgical case No. 3576).—Ed. L., case of Dr. Sherman, Luverne, Minn., age thirty-five; hip disease at 12 years of age; in bed 13 months; abscess and removal of left testicle five years ago; pain in right kidney and chronic cystitis for the past four years. Many tubercle bacilli found in the urine.

Pathology.—Cystoscopic examination made by Dr. H. P. Ritchie, who found tuberculous bladder about right ureteral opening; clear urine from left.

Operation.—Nephrectomy difficult, because small kidney highly placed; rib divided; pedicle slipped, caught with difficulty. For examination of specimen see Fig. 2. On section large abscesses throughout entire kidney. The only portion of normal tissue is at the upper pole. Largest tubercular abscess opening into the pelvis in the lower pole.

Result.—Primary wound union. Recovered. Ten days after operation, wound opened and serous discharge; temperature and pulse normal. May 16, 1912, Dr. Sherman writes that this man is very much alive and is to all appearance enjoying very good health; for a long time he has not complained at all, attending his business every day. Gained 20 pounds in weight.

CASE IV (Surgical case No. 2921).—Mrs. Gilbert A. W., case of Dr. H. Davis; age thirty-five; three children; persistent bladder

distress for past six months. Tubercle bacilli in urine. Cystoscopy by Dr. H. P. Ritchie showed ulcer at left ureteral opening of bladder; pain in left kidney.

Pathology.—Tubercular nephritis and ureteritis; caseous masses in the kidney; miliary tubercles all through; very little normal tissue left; several abscess cavities opening into pelvis of kidney.

Operation (St. Luke's Hospital, January 2, 1908).—Nephrectomy and removal of eight inches of ureter; two gauze drains, one down to stump of ureter. Immediate result: no diminution in amount of urine; bladder distress much improved; slight wound infection. Two months after operation urine better, up two or three times in the night; some discharge from the sinus, two inches deep. April 30, urine normal; sinus three inches deep; gaining weight.

Second Operation (St. Luke's, August 8, 1908).—Sinus still open and discharging pus; gained 25 pounds in weight; no pain.

Pathology.—Tuberculosis of a stump of ureter; bismuth mixture injections has produced no effect.

Operation.—Curettement; tubercle bacilli, granulation tissue; cavity two inches deep.

Result.—August 17, 1908, skin edges still open. Later injections of bismuth paste very little result. February 26, 1909, sinus closed. Last report, May 13, 1912. Patient perfectly well; no trouble with bladder or old sinus; has gained 35 pounds since her operation.

CASE V (Surgical case No. 3640).—Mrs. L. M. I., age forty-eight; sick for five years; nervous prostration, and chronic cystitis; pain in left kidney. Cystoscopic examination by Dr. H. P. Ritchie. Typical tubercular ulceration about right ureter; left ureteral opening normal; left ureteral catheterization one ounce in six minutes, of clear normal urine, no urine from the right ureter. Tubercular nephritis; kidney completely destroyed; one cyst containing watery fluid; rest, cheesy masses.

Operation (St. Luke's Hospital, January 5, 1910).—Nephrectomy; one week after operation patient much better; bladder distress and pain in right side gone.

Result.—Recovered. March 10, 1911, bladder distress returned and is as bad as ever. Incontinence at night; some hemorrhages; quinine and sulphate irrigations, alternating with silver

solution, antiseptic and supportive treatment for one year, with gradual improvement. At present date Dr. Ritchie says that she is perfectly well, weight gained, and comfortable; urinalysis reveals some pus and albumin, but no tubercular bacilli found in present examination.

CASE VI (Fig. 3) (Surgical case No. 3811).—Mrs. A. T., case of Dr. Daigneau, Austin; age forty-four; quite well until two years ago, following violent exertion, nervous prostration, with frequent and painful urination; often every 15 minutes during the day. Past two months relieved by bladder irrigation. Cystoscopic examination by Dr. Ritchie revealed marked tubercular ulceration about the left ureter; tubercle bacilli from catheterized specimen.

Pathology.—Left tubercular nephritis, one large abscess at lower pole, almost broken through the kidney capsule, opening into pelvis of kidney.

Operation (St. Luke's Hospital, September 26, 1911).—Nephrectomy; kidney and eight inches of enlarged, thickened ureter removed; a number of small abscesses in median portion; nodules and caseated areas scattered throughout.

Result.—Bladder distress and temperature gone next morning; returned in two or three days. Recovered. February 1, 1912, bladder distress marked. Cystoscopy showed inflamed base; irrigation of 1:1000 nitrate; relieved. May 16, 1912, Dr. Daigneau writes patient is still uncomfortable, but much better and improving.

CASE VII (University Hospital).—Mrs. M. D., age fifty-six years; married; father died at seventy-eight of pneumonia; mother died at thirty-six of "quick consumption"; three brothers and sisters living and well. Had seven children, all but two being dead. One died of consumption at 16; one of pneumonia at 14; one of pleurisy at 27; two died in infancy. Patient was admitted to University Hospital December 11, 1911, complaining of painful and frequent urination, pain being most marked at end of urination; foul-smelling vaginal discharge between times accompanied by "bearing down" pains in pelvis, and some backache.

Menstrual history negative. Menopause four years ago; childbirths normal; venereal history negative.

Personal history negative except for measles at 14, scarlet fever at 10; some leucorrhœa for past four years.

Three years ago patient noticed severe bearing down pains in lower abdomen, usually preceded by nausea and vomiting. Previous to this time patient was very well. These attacks would come at four- to six-week intervals and last a few hours. Between attacks patient would be perfectly well, but had to take to bed during the attack. Patient was seen by a doctor six weeks after the onset of attacks, who advised the taking of douches, and this brought some relief.

Three months ago after the doctor had inserted a pessary, a profuse foul-smelling pus-like discharge appeared in the vagina, which lasted one day. After this, discharge would appear at three- to four-day intervals, succeeded by numbness and a sense of weight in the pelvis.

Two months ago patient experienced for the first time a severe lancinating pain in the urethra at the end of micturition. On a number of occasions blood or bloody shreds were present in the urine. This has been getting progressively worse. There has been an increase in the frequency of urination for the past two years and now it is on the average of about seven times during the day and three to four times during the night. The total quantity of urine passed has not been increased.

The patient is a well-developed and fairly well-nourished individual. Physical examination is negative excepting for tenderness over left kidney and ureter, and over bladder. Vaginal examination revealed an infiltrated and thickened base of the bladder, exquisitely tender. Uterus not freely movable; cervix firm and bled easily on manipulation.

Cystoscopic examination on December 14 by Dr. Strackhauer showed the whole base of the bladder involved in an ulcerative inflammation, covered with pus and fibrin. Areas about the ureteral openings puffy and oedematous so that openings could not be made out. The bladder was extremely sensitive. A second cystoscopic examination on December 26, after several bladder irrigations with 1 : 1000 silver nitrate solution, showed the mucous membrane to be clearer and less deeply congested, otherwise findings were the same.

Urine examined at different times showed a moderate amount of albumin, few granular casts, and an abundance of pus-cells. On December 16, large numbers of tubercle bacilli were found in the urinary sediment. On January 9, a small shred of bladder

mucous membrane that came away in the cystoscope showed several groups of tubercle bacilli.

A quantitative used and nitrogen estimation of 24 hour specimen revealed a very low (7.96 Gm.) urea output.

Blood examination showed 80 per cent. hæmoglobin, 4,500,000 red blood-cells, and 5400 leucocytes. Temperature ranged between 97° and 98.6°, pulse 56 to 80, respiration 16 to 20.

A diagnosis of tuberculosis of the left kidney with a tubercular cystitis was made, and I performed a nephrectomy on January 16, 1912. The kidney was found adherent to capsule, with miliary tubercles on surface. Thickened ureter as far down as crest of ilium was removed.

Patient rallied from operation fairly well, but afternoon temperature began to appear, rising from 101° to 103°; morning temperature 99° to 100°.

In the early part of March patient began to display signs of gradual decline. A secondary operation to improve the drainage was performed on March 19, 1912, and a drainage tube inserted down to stump of ureter. Patient began to decline rapidly, however, and died March 22, 1912.

The excised kidney showed several nodules about 3 cm. in diameter, which on section were found to be tuberculous abscesses. A number of small abscesses and pin-head nodules were present throughout kidney substance. Cortex of kidney narrow, pyramidal; markings indistinct. Pelvis of kidney and ureter also showed nodules.

CASE VIII (Fig. 4) (Surgical case No. 3920).—E. H., case of Dr. Hopkins, Cumberland, Wis.; age twenty-six. Middle of last July commenced to have pain at end of micturition, with a drop or two of bright red blood after each passage of urine. This continued for two weeks. At present he is very tender over the left kidney, but no discharge of blood for past two months, but complains of frequent attacks of shooting pain into left testicle.

Cystoscopic examination by Dr. H. P. Ritchie showed clear urine from the right ureter, but an intensely inflamed condition of the left ureteral opening. Many tubercle bacilli were found in the urine from the left catheter; none from the right.

Pathology.—Tubercular nephritis; three large sized distinct abscesses in cortex of kidney; few miliary cheesy nodules.

Operation (St. Luke's Hospital, March 29, 1912).—Mayo incision, separating lower left rib; nephrectomy; vessels and upper end of ureters ligated with double No. 3 catgut.

Result.—Primary wound union. Recovered. April 11, 1912, has had mild temperature; no bladder distress; no tubercle bacilli in urine. Wound opened up after reaching home, but looked and felt well.

CASE IX (Surgical Case No. 3933).—O. G., Buffalo, Minn., male, age thirty-seven; single; farmer. Family history negative. Patient admitted to the University Hospital March 19, 1912, complaining of very frequent urination, with pain at the end of the act, with occasional presence of blood in the urine.

About a year ago patient noticed some pain in upper left inguinal region and in a less degree on right side. This pain was increased by hard work, especially by lifting. The pain would often localize itself in left sacro-iliac joint and be very sharp in character. About three months ago patient was suddenly seized with a sharp pain in the suprapubic region. This condition grew progressively worse, up to the present time, and urination became more frequent. Six weeks ago, patient noticed that in the early morning urine the first portion passed would be cloudy, then clear, and the last contained blood. At times the pain after urination would last for three-quarters of an hour. General health remained good. Exertion or stooping over brought on the pain in left lumbar region.

Patient was a very well-developed and well-nourished individual. Physical examination revealed nothing abnormal except for tenderness over the bladder region.

General urine examination showed abundant albumin, no casts, numerous leucocytes and red blood-cells; a stained sedimentated specimen showed large number of clumps of tubercle bacilli.

Cystoscopic examination by Dr. Strackhauer on April 1 revealed a number of small ulcers distributed over the base of the bladder; right ureteral orifice apparently normal. An ulcer the size of a hazel-nut present at right of left ureteral orifice, and many tubercle bacilli in catheterized specimen from the left kidney; none from the right.

Blood findings were: hæmoglobin 85 per cent.; leucocytes 7300. Differential count gave 34 per cent. lymphocytes; 8.4 per

cent. mononuclears; 20 per cent. transitionals; and 55.2 per cent. polymorphonuclears. Temperature, pulse, and respiration normal during stay in hospital.

When prepared for operation it was reported to the attending surgeon that there was evidence of active tuberculosis in his left apex. Examination by the medical side confirmed these findings and they advised against giving a general anæsthetic. A consultation was held by the medical staff, Drs. Moore, Law, Dennis, Hare, Strackhauer, Ritchie, and myself. It was decided, as the man had no dyspnœa or cough, that it would be better to proceed with the operation, which was performed on April 20, 1912.

Operation.—Removal of the kidney. There was considerable hemorrhage from the slipping of the clamp. The man stood the operation well, but had a mild wound infection. He is still in the hospital but rapidly improving and quite out of danger.

THE TOMATO JOINT.*

BY ROBERT W. JOHNSON, M.D.,

OF BALTIMORE.

Professor of Surgery in the Baltimore Medical College.

THIS is not a discovery, it is a reminder.

Had Mrs. Bardell, instead of Mrs. Leo Hunter, said to Mr. Pickwick, "I must make you promise not to stir from my side the whole day," she could not have taken a more secure way of enforcing his presence than to fill out the famous menu emphasized by Sargeant Buzfuz at the notorious trial.

"Chops and tomato sauce, yours, Pickwick; chops! gracious heavens! and tomato sauce!" The great novelist, true to nature, though possibly wrong in his pathology, elsewhere states "Mr. Pickwick was laid up with an attack of rheumatism." Mr. Weller, Sr., rushes in where angels almost fear to tread, with his diagnosis and treatment of gout as follows:

"The gout is a complaint as arises from too much ease and comfort. If you're attacked with gout, sir, jist you marry a widder as has got a good loud voice with a decent notion of usin' it and you'll never have the gout again. It's a capital prescription, sir, I takes it regular and I can warrant it to drive away any illness as is caused by too much jollity."

My real reason for bringing this subject before you is that frequently, especially in the autumn, we are called on to see cases of joint involvement that have all the earmarks of surgical trouble. As in the life history of hip-joint disease, there has been a fall, a twist, or bruise at some time or other, so with this joint affection and with the pertinacity of those who use psychic analysis for "psychic trauma" we can generally bring out by careful and positive (possibly leading) questioning a history of sprain or strain about the time of joint discomfort. If the knee, a favorite joint, be involved, we find it enlarged, swollen, tense, or with marked effusion but not red, painful especially on motion but the pain of rather a subacute condi-

* Read before the American Surgical Association, May 30, 1912.

tion, with slight increase of local heat. The floating patella can be made to strike the condyles, and occasionally the joint is caught in extension and with difficulty flexed, due to the displacement of its constituents by the effused fluid. If you are not the first consulted, you will find evidence of treatment dependent on the energy and ignorance of the previous attendant, and ranging all the way from the cosmetic effect of iodine to mechanical fixation in plaster. When asked if the treatment has done good, the patient affirms "not a bit," or in the words of that practical joker, Osler, who popped his head into my office one morning and told me before my waiting patients, "That trouble has all come back." I had the presence of mind to say, "You should have been ashamed to have gotten it in the first place"; but you cannot say that to these patients, for there is more obloquy to the surgeon that has treated them thus than to the sufferer himself.

I have seen some of the best and most careful men make mistakes in these cases, simply because they are not satisfied with an easy diagnosis, or get a preconceived fixed idea from the history and appearance of the joint. I will not go into the minute examination of the urine, beyond stating in a general way that it is hyperacid with marked evidence of urates in the brick-dust deposit, nor are the other signs of uric acid diathesis, as we used to call it, absent—depression, acid, dyspepsia, occasionally pruritus, and even eczema. Nor is the pain limited to joints alone, for we find it simulating intercostal neuralgia, gall-stone, podalgia, or severe pain in the fibrous tissue about the os calcis. I recall an instance which looked almost like hysteria. I was called to see a gentleman with pronounced pain in his heel, without much local evidence, and before I got home I had a similar pain that nearly kept me from walking. I recognized in both instances the cause, *i.e.*, we had both indulged in tomatoes.

When you think that there are over 288,000,000 quarts of canned tomatoes consumed in these United States a year, not to speak of the millions used in the natural state, one wonders almost that some are not drowned in the flood of acid that

engulfs the American, whether he is a boarder or a sojourner at home. In nine cases out of ten you will find on taking the history of your joint patient, or I may go farther, treating obscure indefinable aches, that the tomato is the basis for the acid condition, and if we add coffee, we can increase our percentage to 99/100. Both are so seductive,—the raw, the salad, the broiled for breakfast, the fricasseed, the baked, the soup, the sauce, the stew, etc. (I have placed them in the order of their malignancy),—really figure so in our daily lives, that modern theology might do well to substitute the tomato for the apple as Eve's most insinuating and dangerous delicacy, and fix as the French have done its appellation of *pomme d'amours* in contradistinction to our Irish friend, *pomme de terre*.

So much for the etiology and symptoms. What is the prognosis? That depends so on treatment that the personal equation of the surgeon and not the patient has to be taken into consideration. If the cause is recognized and removed, then we may look for recovery inside of 48 hours. If the surgeon thinks that the waters of Abana and Pharphar are better than lithia water, or if he thinks that the expectant plan with rest is proper, one cannot say how long it will take nature to counteract the tomato, especially if that delicacy is continued. I have never seen a case go on to suppuration, and I believe time will cause the absorption of the effusion; but why wait when the whole trouble may be cured in 24 to 48 hours by recognition of the devil that has entered into the man *via* the tomato can, and can be cast out *via* the lithia water bottle? Hence the treatment is simplicity itself. Exercise pressure and some restraint on the joint by a closely applied flannel bandage, without necessarily in all cases taking the patient off his feet, and then by means of lithia water or some such salt counteract the acid which is irritating the serous membranes, thus producing the effusion. From henceforth, tomato must be *anathema-maranatha* to that patient. Whether this is a form of gout or rheumatism, I am not prepared to say. I have reminded you of a condition we often see and sometimes misinterpret.

ACUTE INFLAMMATION OF THE LONG BONES.*

BY ROBERT G. LE CONTE, M.D.,

OF PHILADELPHIA,

Surgeon to the Pennsylvania Hospital.

I DESIRE to make a short report of some of the features developed in a study of a series of 80 cases of acute inflammation of the long bones operated upon in the Pennsylvania Hospital. All chronic cases, syphilitic, and tuberculous lesions have been eliminated.

Etiology.—At the present time many believe that trauma is hardly to be considered as a predisposing cause, but we still think that it initiates these inflammations in a large proportion of cases. Fifty of these patients, or 62 per cent., were between the age of 5 and 20 years, that is, during the period of greatest muscular activity. Sixty-five, or 81 per cent., were in males, and with the 48 histories in which there was a record of trauma, it occurred in 38, or 80 per cent.

The exciting causes are the usual organisms of suppuration. In 23 cases where a bacteriological examination of the pus was made, *Staphylococcus pyogenes aureus* was present in 13, or 56 per cent.; *Streptococcus pyogenes aureus* represented 13 per cent., and the rest were scattered.

The localization of the starting point of the lesion is very important, for it has been our experience that when the original focus has been found and all the necrosed tissue removed at the primary operation, secondary operations are very rarely required, and when required are only minor in character.

Stone, in 1907, called attention to the frequency with which bone lesions in infants and young children were found

* Read before the American Surgical Association, May 30, 1912.

in the epiphysis, and Homans in a recent report of osteomyelitis in children under 12 years of age, found 84 per cent. of the lesions originating in the ends of the bones, *i.e.*, in or near the epiphysis. In our group of cases we find the lesion originating in the ends of bone in 50 out of 55 cases (90 per cent.) before the fusion of the epiphysis and diaphysis. In 14 cases occurring after the age of epiphyseal union, 8 (57 per cent.) were found in the end of the bones. In 11 cases we were unable to determine the origin of the lesion. It is therefore fair to assume that during infancy and childhood these suppurations nearly always originate near the epiphysis, but after this age they may occur with equal frequency in the shaft or the ends of the bone.

In a paper published a year ago, in the *Boston Medical and Surgical Journal*, we believed that the majority of the bone inflammatory lesions originated beneath the periosteum, but in a more careful study and a division of the cases into lesions originating before and after epiphyseal fusion, we find that after epiphyseal fusion a number originated beneath the periosteum and subsequently became medullary, while before this union takes place the large majority originate centrally, the pus escaping at the ends of the bone into the periosteum and surrounding tissues.

The localization of the suppurating focus to the periosteum, the cortex or medulla, is essential but more difficult. In children before the age of epiphyseal union, Homans believes that the bulk of the infections originate in the medulla, while Stone found that they rarely involved the medulla, originating in the epiphysis and then becoming subperiosteal. These cases are always acute, and unless the X-ray is taken early in the disease the origin of the primary focus is in doubt. With us the cases came under observation too late in the disease to either affirm or deny these opinions.

An analysis of our cases shows that the character of the operative treatment has a very decided effect upon the course and virulence of the disease. We have divided the cases according to their treatment into five groups:

Group I: Within 96 hours from the onset of symptoms. At the primary operation the medullary cavity was opened and all of the inflamed tissue thoroughly removed. Subsequent operations, none. One death six hours after operation from progressive septicæmia.

Group II: From four to seven days after the onset of symptoms, at the primary operation the medullary cavity was opened and a considerable portion of inflamed tissue removed.

Group III: More than seven days after the onset of symptoms. At the primary operation the medullary cavity was opened and a considerable portion of inflamed tissue removed. Where the whole of the inflammatory tissue was removed in Groups II and III no further operations were necessary.

Group IV: At primary operation only the superficial tissues and periosteum were incised and drained. Medullary cavity not opened.

Group V: At the primary operation the superficial tissues only were incised and drained. Periosteum not opened.

In the first three groups the focus of disease was found and more or less completely removed. With the delay in time of operating, there was an increase in the amount of bone destroyed, the time required for the period of repair, the number of unhealed lesions, and in the subsequent number of operations.

| Drainage of Medullary Cavity at Primary Operation. | Total | Group I, within 96 Hours. | Group II, between Fourth and Seventh Days. | Group II after Seventh Day. |
|--|-------|------------------------------------|---|--------------------------------------|
| Total cases | 27 | 5 | 8 | 14 |
| Osteomyelitis local, per cent. | 68 | 80 | 61 | 64 |
| Osteomyelitis general, per cent. | 20 | 0 | 25 | 35 |
| Entire shaft destroyed, per cent. | 13 | 0 | 12 | 28 |
| Unhealed, per cent. | 15 | 0 | 25 | 21 |
| Period of repair, days.. | 106 | 64 | 75 | 180 |
| Subsequent operation, re- quired, per cent. | 24 | 0 | 37 | 36 |
| Deaths, per cent. | 10 | 20 | 12 | 0 |

FIG. 1.

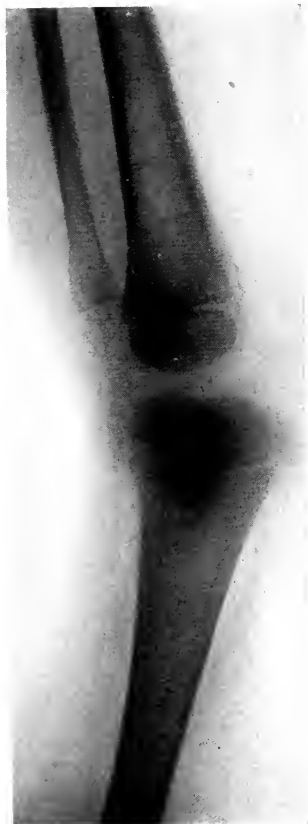


FIG. 2.



Acute, localized osteoperiostitis of tibia. Thickening and elevation of periosteum: rarefaction of the cortex.

Localized osteoperiostitis of tibia. Erosion of bone.

FIG. 3.



Localized osteoperiostitis of upper third of humerus. Erosion of bone; thickening of the periosteum.

FIG. 4.



Localized osteoperiostitis of tibia. Thickening and elevation of periosteum; rarefaction of cortex.

FIG. 5.



Diffuse osteomyelitis of twelve years' duration.

FIG. 6.



Localized osteomyelitis.

FIG. 7.



Entire diaphysis of tibia removed at operation.

FIG. 8.



Regenerating bone eight weeks after complete resection of the shaft of the tibia for acute osteomyelitis of four weeks' duration.

FIG. 9.



Same patient as Fig. 8. Regeneration of bone 12 weeks after resection.

FIG. 10.



Same patient as Figs. 8 and 9. Two fractures one year after resection of tibia. Final union.

FIG. 11.



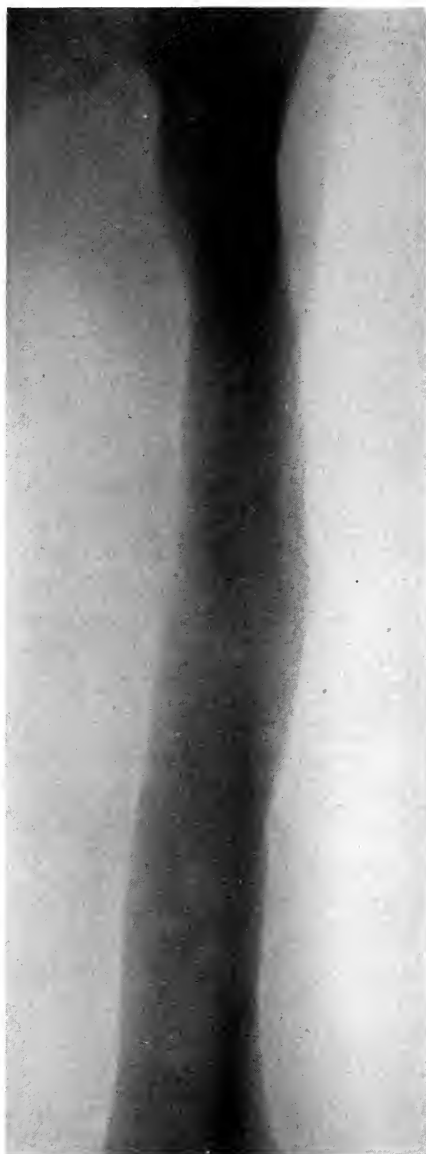
FIG. 12.



Photograph of the same patient as Fig. 11.

Regenerated tibia thirteen years after complete subperiosteal resection for acute osteomyelitis.

FIG. 13.



Regeneration one year after excision of the upper three-fourths of the humerus.

The influence of the character of the operation is still more striking by comparing the totals of Groups I, II and III, in which a more or less ideal operation was done, with Groups IV and V of incomplete surgery.

| | Groups I, II and III, Drainage of Medullary Cavity | Group IV, Drainage of Periosteum | Group V, Drainage of Superficial Tissues |
|--|--|--|---|
| Total | 27 | 20 | 33 |
| Osteoperiostitis, per cent. | 0 | 10 | 9 |
| Osteomyelitis, local, per cent. ... | 68 | 35 | 31 |
| Osteomyelitis, general, per cent.. | 20 | 45 | 30 |
| Entire shaft destroyed, per cent.. | 13 | 35 | 18 |
| Unhealed, per cent. | 15 | 25 | 24 |
| Period of repair, days | 106 | 116 | 250 |
| Subsequent operation required, per cent. | 24 | 175 | 160 |
| Deaths, per cent. | 7.4 | 10 | 9 |

In many of the cases of Groups IV and V, if not in all of them, the medullary cavity was involved at the time of the primary operation but was not opened, as the operator, finding a considerable subperiosteal abscess or abscess of the soft tissues, was satisfied with draining it. The original focus of infection was therefore not touched at the primary operation. It must be remembered that superficial lesions of the soft tissues or beneath the periosteum do not exclude a medullary involvement, for the infection often is so virulent that periosteum, cortex, and medulla are all involved as early as 72 hours after the onset of symptoms. When we find pus in the soft tissues the periosteum must be explored, and when pus is found beneath it, the medullary cavity should always be opened, if four days have elapsed since the onset of symptoms. In two cases we found the medulla healthy and no infection of the medullary cavity took place as a result of opening it.

A study of these cases emphasizes clearly to us two points in the treatment: the necessity of a prompt operation with adequate drainage of the primary focus of infection, and the removal of all diseased bone at the primary operation, even if that removal entails a more or less complete excision or resec-

tion of the shaft. We have found there is no point so early in the disease that the periosteum fails to reproduce the bone removed, but at a later time, somewhere between six months and a year, the reproductive power of the periosteum is exhausted and it fails to regenerate bone. When the condition of the patient warrants it at the primary operation, radical treatment greatly shortens the time of convalescence, prevents further destruction of bone, lessens the subsequent number of operations, and reduces the mortality.

SURGERY OF THE LONG BONES.*

BY JAMES E. MOORE, M.D.,

OF MINNEAPOLIS.

Professor of Surgery in the University of Minnesota.

THE most interesting phase of the surgery of bones at the present time is the treatment of fractures through open wound. It has already an established place in surgery but its limitations are not yet clearly defined. The tendency at the present time is to overdo and to operate upon some patients who would have good results without operation, and we have no moral right to change a simple into a compound fracture except when the welfare of the patient demands it. I am confident, however, that as our experience increases even the most conservative surgeon will employ it in some cases not now considered suitable.

The Lane plate is doubtless the best device for fixing fragments through open wound. The clavicle is not well adapted to the use of the plate because of its shape and because it is too close to the surface. A bone so shaped or a fracture so located that only one screw can be placed in one end of the plate is not well adapted to the use of the plate, because the one screw so frequently fails to hold. Most of the plates I have been obliged to remove after my own and other surgeons' operations have been very close to the surface. In one case in which I used a plate for a fractured clavicle satisfactory union was secured but the plate had to be removed later because the one screw had loosened and was causing pain. In most cases where it becomes necessary to remove the plate it has already performed its function and bony union secured, so that the mere fact of its having to be removed does not militate against the operation. In no single instance have I known the use of the plate to be followed by disaster. Had I

* Read before the American Surgical Association, May 30, 1912.

used silver wire in my clavicle case the patient doubtless would have been saved the second operation but he could not have had a better result.

Our greatest disappointment in the use of the plate is in compound fractures, for these are the very cases in which it would be most helpful, but the lowered vitality of the tissues caused by the accident prevents them from healing over a foreign body and infection, the greatest danger in compound fractures, occurs more frequently when plates are used. The wound will sometimes heal over the plate after an infection. It is a very common experience to have some serum escape from the wound after introducing a plate and still have the wound heal kindly. I placed a plate upon the radius of one patient who had been treated for a comminuted fracture of both bones of the forearm. The ulna was well united in good position but was shortened. The radius was united with a very large callus and a pronounced bowing outward. The surplus callus was removed, the radius shortened and straightened, and the plate fastened to the outer side with four screws. The wound healed promptly. A plaster splint was applied and the patient allowed to go home. Several weeks afterward the patient wrote to me that the wound had opened. Three months after the operation he came back with an open suppurating wound, a loose plate and an ununited fracture. The plate was removed, the wound thoroughly mopped with iodine, the ends of the fragments freshened and another plate immediately applied to the dorsum of the radius. The wound suppurated very freely but drainage was good, so that the patient suffered no serious effects. At the end of three weeks the patient went home with the wound all healed but one small sinus. After two months the patient returned with firm bony union, but the sinus still remains. The mere presence of a sinus is not a positive indication for the removal of a plate, for it will often close with injections of bismuth paste or balsam of Peru.

The most unpromising cases are those ununited fractures where for reasons unknown the patient fails to produce

osteoblasts and no callus is formed. I have secured bony union in one such case at the end of six months by the use of Lane's plates. The use of a bone splint taken from the patient's own person, so ably advocated by Murphy, is doubtless our best resource in these cases.

The greatest advance in the surgery of the long bones in recent years is in the treatment of fractures of the neck of the femur. It has been clearly demonstrated that our former reasons for non-union of the neck of the femur were fallacious, and that the principal reason is that the fragments have not been properly reduced and held in place. Since December, 1903, I have employed the two-way pull of Maxwell, and in only one instance where a 93-year-old patient died, have I failed to secure bony union, and in one of my patients the dressing was not applied until four weeks after the accident. With the exception of those rare cases where the joint capsule is torn and prevents reduction of the fragments, fractures of the neck of the femur can be treated with as great assurance of bony union as can fracture of the shaft. Fig. 1 illustrates the principle of Maxwell's dressing. The usual Buck's extension is applied and an additional pull of twelve or fifteen pounds upward and outward at an angle of forty-five degrees, so that the resultant of the two pulls is in the direction of the long axis of the neck. This draws the large fragment outward, making the capsule of the joint taut in the form of a hollow cylinder. The short fragment is attached by the ligamentum teres at its proximal end with the distal end floating free within the capsule, so that when the capsule is drawn taut the fractured surfaces are brought together and held there.

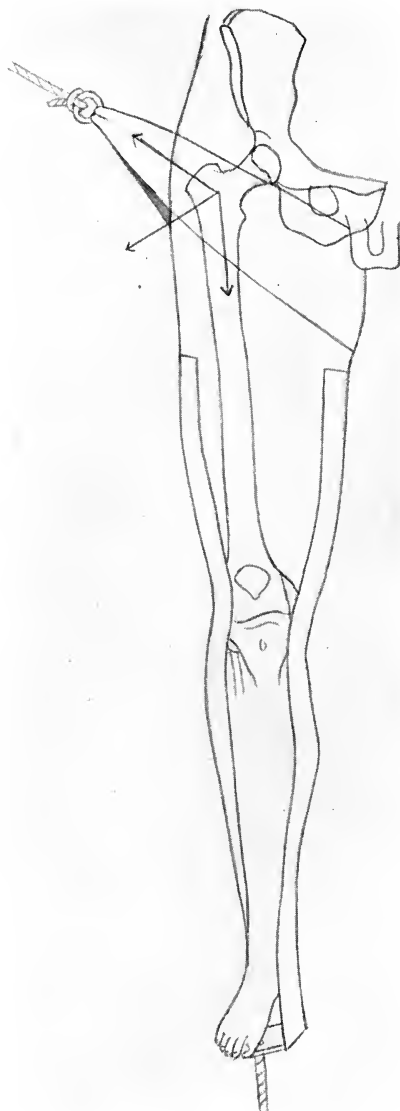
Another fallacy connected with fractures of the femoral neck is the belief that it is confined to old people. Since my attention was called to this matter by Whitman I have seen several cases of fracture of the neck of the femur in children. They are often of the green stick variety, and at first are treated as sprains or contusions and later as cases of coxa vara. Whitman's treatment by a plaster of Paris splint with

the limb in extreme abduction is simple, comfortable and efficient.

Notwithstanding the fact that the Maxwell and the Whitman methods of successfully treating fractures of the neck of the femur have been taught for years, a great many, I fear the majority, are still being treated by the old methods, the usual result being non-union. But even then all hope is not lost, for when the patient is not too old the fracture can be successfully treated through open wound. Fig. 2 is from a skiagraph of a hip I operated upon two and a half years after the accident. By sawing off the great trochanter and turning it up, the joint can be readily exposed, the broken surfaces freshened and the fragments nailed together. The trochanter is then nailed in place and the usual dressing applied. Extension is not necessary after the operation, as the nails together with the splint are sufficient to retain the fragments in place.

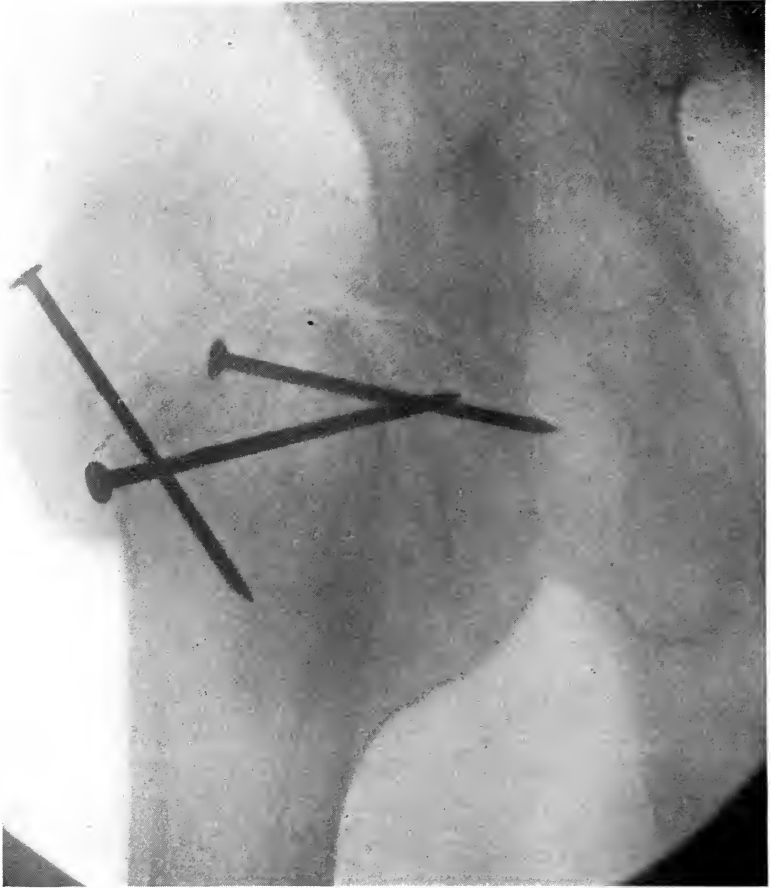
Osteomyelitis furnishes a large percentage of surgery of the long bones, and since I have learned to use the Moorhof bone wax these cases are among the most satisfactory in my practice. Notwithstanding the fact that every teacher of surgery lays special stress upon the early diagnosis and prompt operative treatment of osteomyelitis, these cases are very commonly treated as rheumatism until the time for stopping the ravages of the disease has gone by, and the consequence is that we are called upon to remedy the mischief done by the disease much more frequently than we are to operate for the relief of the disease itself. Unfortunately when the diagnosis is made the operator is too often content to cut down to the bone evacuating the secondary outside abscess without opening the medulla. This does not relieve the internal pressure and the necrotic process goes on inside. Another very common mistake is to make too small an opening into the bone. A small drill or trephine hole is rarely sufficient. A liberal opening should be chiselled through the compact tissue of the bone and moist dressings applied. Nichols made the important suggestion that the infected medulla should not be curetted out, as this destroys much bone producing tissue and it is

FIG. 1.



The two-way pull in treating fracture of the neck of the femur (Maxwell).

FIG. 2.



Fracture of the neck of the temur secured by nails.

FIG. 3.



Repair after fracture of neck of humerus complicating osteomyelitis; sequestrum removed.

unnecessary because when the hard shell of the bone is thoroughly opened nature will do the rest. It is astonishing how some of these cases are neglected. I recently operated upon a patient in the University Hospital who had evidently been suffering from an abscess in his tibia for twenty-eight years.

The old operation for the removal of a sequestrum where the cavity was packed and repacked indefinitely with gauze was very trying to both patient and surgeon. The treatment was very tedious, very painful to the patient, and always left a very unsightly scar. You will pardon me, I am sure, for going a little into detail of the technic for the use of the bone wax, for many failures have been reported after its use and these failures surely must have been due to faulty technic, for in my practice and in the practice of other surgeons with which I am familiar it is an undoubted and even brilliant success. During the operation the Esmarch bandage should always be used, otherwise the patient may lose too much blood. I have known one patient to bleed to death from the lack of this precaution. Where the soft parts are healthy so that complete primary union may be hoped for, the bandage should be removed after the sequestrum has been removed and the cavity sterilized, and the oozing controlled by hot water or hot air until the cavity is thoroughly dry before the wax is introduced. While the circulation is cut off by the bandage the cavity may be sterilized by filling it with carbolic acid and allowing it to remain from three to five minutes, after which it should be mopped out and the cavity repeatedly washed with alcohol. This is perfectly safe because no absorption can take place while the bandage is applied. Great care should be exercised to protect the soft parts from the acid, as it will cause a layer of necrosis which will interfere with union. Some of the reported failures were doubtless due to a neglect of this precaution.

In cases where the soft parts are blue, or made up partly of scar tissue, primary union throughout can not be hoped for, and the wax may be introduced before removing the Esmarch as this will materially shorten the operation. The sharp edges

of the bone on either side of the groove should be chiselled off to prevent pressure necrosis of the flaps. The cavity should be thoroughly dried before introducing the wax. Moorhof used a special hot air blast for this purpose, but the evaporation of the alcohol is usually sufficient. The drying may be hastened by introducing the electric cautery blade into the cavity, being careful not to bring it in contact with the bone so as to cause necrosis. After the cavity is sterilized and dried the limb should be held horizontal and the melted wax poured in or injected with a syringe, care being exercised that it is not hot enough to damage the tissues. The periosteum is then closed over the wax by a running suture of chromicised catgut. The integument is then closed with a running suture of iodized catgut. I have found it expedient to introduce a few interrupted stay stitches of silkworm gut, as the catgut sometimes absorbs too soon, allowing the wound to gape. These stay stitches can often be left for a month without causing harm. A liberal dressing of dry sterile gauze is next applied and held in place by a snug roller bandage, over which a plaster of Paris bandage is applied. In cases where the soft parts are healthy this dressing may be allowed to remain from two to four weeks, when the wound will often be found completely healed. Not infrequently one or more sinuses will remain for a time, through which serum colored yellow from the iodoform, will drain, but if kept sterile they will eventually heal. After a number of months, depending upon the size of the cavity, the wax is absorbed and replaced by bone. When the soft parts are blue or partly scar tissue, the dressing should be changed in ten days or two weeks, when the wound will usually be found partly gaping, exposing the wax. The wound is dressed with sterile gauze impregnated with balsam of Peru, and it will gradually heal over. This process is usually somewhat tedious, but the patient is perfectly comfortable and can often use the limb while the healing process is going on. The wax will sometimes work out in these open cases, but so long as the wound is kept sterile more melted wax can be poured in. Even in these

open cases the patients are so much more comfortable and the time of healing so much shorter than after the old packing method that there is no comparison.

When a pathologic fracture occurs from osteomyelitis the periosteum is usually preserved and nature will bring about a cure if the sequestrum is removed and the limb properly cared for.

This picture (Fig. 3) is from skiagraph of a boy's humerus, showing complete restoration of bone of normal size and shape, after a pathologic fracture and removal of a sequestrum consisting of an inch and a half of the whole circumference of the shaft.

I have found the bone wax very useful in complete excision of the elbow. The cavity is completely filled with the wax which remains long enough to prevent the bones from coming in contact, and being surrounded by soft parts is gradually absorbed and replaced by connective tissue. Since I have used the wax in these cases my patients have been more comfortable and have obtained better results than formerly. There is quite a free oozing of yellow serum for a time, but the wound has always healed satisfactorily.

END RESULTS OF FRACTURE OF THE SHAFT OF THE FEMUR.*

BY WILLIAM LAWRENCE ESTES, M.D.,

OF SOUTH BETHLEHEM, PA.

Director and Surgeon in Chief of St. Luke's Hospital.

THE femur on account of its location in the skeleton, its function, and its great size produces when broken a very serious condition both as regards the immediate effect and the ulterior consequences.

The vulnerability of this largest and strongest bone of the skeleton is rather astonishing considering its great strength, but if one bears in mind its location and the almost constant exposure of this bone to injury in all kinds of strenuous manual and mechanical labor, it is not wonderful that it is so frequently fractured.

The records of St. Luke's Hospital show that of 1869 fractures of all kinds admitted into the wards 245, or 13 per cent., were fractures of the shaft of the femur; 167 were simple fractures and 78 were compound, comminuted, or complicated fractures.

The violence necessary to fracture the shaft of the femur must be very great, the consequent injury must therefore be very considerable, and the resulting condition one which deserves most careful consideration and skilful handling.

The systematic employment of radiograms to illustrate and to check the result of formal reduction of all major fractures showed such marked lack of accurate restitution of fragments in cases of apparently good restitution that the former confidence which he felt in treating a case of fractured femur was so thoroughly disturbed in the writer's case that he set about reviewing all of his own available cases and collecting the experience and results of other surgeons in regard to these

* Read before the American Surgical Association, May 30, 1912.

fractures; also to collect and to compare the results of the closed and open methods of treatment.

In judging the results of treatment of fractures of the femur one must take as a standard, either, first, good functional results alone, or, second, good function and satisfactory cosmetic results.

Both the growing estheticism of the period and the common use of radiography require one to adopt the second standard, namely, end results of fractures should be estimated by good functional and satisfactory cosmetic results.

Surgeons who assert that good functional results alone should determine the value of the treatment reason probably that the human frame readily adapts itself to conditions of acquired asymmetry. Notwithstanding some shortening, overlapping of fragments, change of the angle of support, and variation of leverage and fulcrum if the fragments are firmly united, the final result may give the patient good function, in that he can use the member without serious inconvenience and without noticeable awkwardness of station or motion. But it will require a long time for the rest of the skeleton and the muscles to adapt themselves to the changed conditions and acquire the position and habit of good function.

Good cosmetic results, by which I mean such accurate restoration of fragments to their proper positions that no deformity results, and which means good end-to-end reposition without deviation of the angle of support, will require no new habits in balancing to be learned, nor any new tricks of the muscles to be acquired in order to have the proper function of the member restored without pain or lasting discomfort.

Good cosmetic results alone will not suffice of course. I have seen cases recover with absolutely no appreciable deformity and good union but with complete paralysis of the muscles.

Notwithstanding the fact that radiograms may be misleading and inaccurate (they are practically always so when taken by inexperienced operators), they furnish at the present time, when properly taken by a qualified operator, the best guide and

indication of the relative position of fragments in cases of fractures. Also it has become the custom of patients to insist that an X-ray picture be taken of their fractures after the "setting" has been done.

It is sometimes quite impossible to convince a layman that a good functional result may be expected even if the restitution of fragments has not been accurate.

It becomes more and more important therefore for the surgeon to strive for good cosmetic as well as good functional results.

Another very important matter to determine is what standard shall be established as the criterion of good functional and cosmetic results of fractures, especially of fractures of the shaft of the femur.

The one almost universal standard hitherto has been the resulting shortening. It is a fact that none or very little shortening will result if accurate restitution has been made in cases of fractures; so shortening of any degree will indicate overlapping and illy placed fragments. But it has been incontestably shown that this standard is very inaccurate, because the lower limbs are rarely of the same length in any human being.

Drs. John B. Roberts,¹ Jarvis S. Wight,² Thos. G. Morton, T. W. Huntington,³ and Algernon T. Bristow,⁴ showed by careful measurements of the dried femurs of skeletons, and by measuring the two lower extremities of a large number of men that they vary from 0.1 to 3 centimetres in length in normal conditions. Spasms of the muscles, tilting of the pelvis, and flexions of the joints multiply these variations very much in cases of recent fractures, and especially after the various fixation and traction apparatus have been used for several weeks. I have measured limbs after union of fractures of the femur which showed very decided overlapping of the fragments, and by careful and repeated measurements as ordinarily prescribed and used, found very little shortening. I remember one case, a man who had two and a half inches shortening, who walked long distances without pain or inconvenience and

who undoubtedly had good function though there was marked deformity.

The methods of measuring, too, introduce very frequently serious inaccuracies. The method probably most frequently employed, viz., the distance from the anterior superior iliac spines to the tip of the internal malleolus, is only approximately accurate and is usually not properly employed. Dr. W. W. Keen suggested the proper way of taking this measurement. The point of the malleolus should be the fixed point of departure and the anterior spines should be indicated by a horizontal line drawn transversely over them. It is very important to know that the pelvis is not tilted when this measurement is taken and that the two anterior superior spines are in the same horizontal plane. Care must be taken to make no pressure on the skin over the spines because it is quite loose and slips upward easily, thus making a measurement longer than it should be. One end of the tape should be held by the tip of the thumb firmly at the middle lower rounded edge of the internal malleolus and the other carried up by the other hand of the operator and stretched over the horizontal line made over the anterior superior spine, and the reading taken without pressing on the skin at this point. This measurement should always be checked by taking other measurements, for instance, the distance from the ensiform cartilage of the sternum or from the umbilicus to the patella or internal malleolus. Dr. Gerrish recommends measuring from the incisor teeth (the patient to hold one end of the tape between his teeth) to the knee, and malleolus on either side. Respiratory movements and varying conditions of distention of the abdomen are liable to make any measurements from a point above the pelvis to the knee or malleolus inaccurate and I think should never be used alone.

Even if no or very little shortening follows these fractures, angulation, usually exhibited by eversion or inversion of the foot, very seriously interferes both with functional and cosmetic results. Also arthritides and ankyloses seriously retard or prevent complete restoration of function. Evidently the degree of shortening alone is not a competent criterion of the

completeness of recovery from these fractures. The text-books and authoritative writers are far from clearness and precision in these crucial points in regard to fractures of the femur.

In 1890 the American Surgical Association appointed a commission to determine and report what should be considered the conditions which would indicate satisfactory end results of simple fractures of the shaft of the femur.⁵

Stephen Smith was chairman of this commission and besides him the membership consisted of Drs. D. Hayes Agnew, David W. Cheever, D. E. Yandell, Chas. F. Parkes, P. S. Connor, Chas. B. De Nancrede, and Hunter McGuire.

The report of this commission summarized was as follows: (1) there must be firm bony union; (2) there must be correct axial relations of the fragments; (3) correct relations of the anterior planes of the upper and lower fragments must be maintained; (4) shortening must not exceed from one-eighth inch to one inch; (5) lameness must not result as a consequence of shortening over one inch; (6) the conditions attending the treatment, however, may prevent these satisfactory results.

Dr. Thos. W. Huntington of San Francisco, in a paper published in the *ANNALS OF SURGERY*, September, 1908, on "Operative Treatment of Recent Fractures of the Femoral Shaft," quotes replies to a questionnaire from 92 surgeons of the United States and Canada. Of these 92 surgeons, 69 think one inch or more shortening permissible after these fractures, 19 think not more than three-quarters inch, and only four think one-half inch should be the permissible degree of shortening. Two years ago in preparing a paper on this same subject, the writer sent a list of questions in regard to these fractures to 50 surgeons of the United States and Canada, and received 25 replies. These have been recently augmented by 10 replies to late inquiries.

To the questions, first, Have you been uniformly successful in obtaining good cosmetic results in your cases, 10 answer yes, 25 answer no.

Second, What do you regard as the permissible shortening after fractures of the shaft of the femur? Answer, one-quarter, to one inch.

American surgeons evidently regard one-half inch shortening as a very good result, and as much as one and a half inches may not be regarded as a bad result. Shortening equal to one inch necessarily means inaccurate reposition of the fragments and a large overlapment of callus in order to procure firm union. This almost of a necessity contravenes the second and third requirements stated by the commission of the American Surgical Association of 1890.

It is also very important to find out whether any special apparatus, splint, or fixation device seems to be favored by the majority of surgeons, and especially whether surgeons are at present advocating the open method of treatment as a routine one in hospitals; if so, are the results of this treatment much better than the old method.

The Pennsylvania State Medical Society appointed a commission of which the writer was made chairman in 1910, consisting of Drs. Edw. Martin, J. B. Roberts, C. E. Thomson, Geo. W. Guthrie, A. R. Allen, W. S. O. Sherman, Otto Gaub, Alex. G. Fell, Walter Lathrop, and W. L. Estes, to collect reports of fractures of the shaft of the femur, to study the whole subject, and to report at the next annual meeting.

The commission collected and collated as far as the reports would permit 278 cases as follows:

1. Total cases, 278.
2. Ages: below ten years, 70; between 10 and 20 years, 43; between 20 and 50 years, 105; between 50 and 70 years, 38; between 70 and 80 years, 12; between 90 and 100 years, 1; cases not mentioned, 9.
3. Occupation: working people, 168 cases; cases not noted, 33.
4. Cause of fracture: direct violence, 83; indirect violence, 176.
5. Seat of fracture: 195 cases has this noted. Of these, upper third, 37; middle third, 106; lower third, 52.
6. Kind of fractures: simple, 245; compound, 17; compound comminuted, 2; complicated and multiple, 6.
7. Amount of shortening at time of injury (admission):

of 112 cases noted, average shortening before reduction was 1.77 inch.

8. Method of treatment: of 221 cases noted, some form of Buck's extension, 117; Scudder's splints, 24; plaster of Paris, 19; long lateral splints, 21; sand bags, 10; Hodgen's apparatus, 3; double inclined plane, 2; open method, 11; various form of splint, 3; no dressing, 1.

9. Anæsthetic: yes, 96; no, 143; 82 cases not noted.

10. Extension, average amount of weight used: of 147 cases reported, 13.2 pounds was the average.

11. Effects of reduction on shortening as determined by measurements recorded in only a few cases.

12. Amount of shortening: *a, b, c*, these were not taken as a rule; *d, e, f*, reports too few to be used on these points.

13. Length of time in bed: of 206 cases reported, average a fraction less than 7.5 weeks.

14. Length of time absent from work: of 114 cases reported, average a fraction less than 3.5 months.

15. Length of time crutches, canes, or other aids to walking were used: of 98 cases reported, average a fraction less than 9 weeks.

Note.—No. 15 was understood differently by various reporters; the answers varied very greatly.

16. Presence or absence of limp: of 202 cases reported, 163 limped.

17. Inversion or eversion of foot or tilting of pelvis, causing serious axial displacement: of 157 cases reported 136 had no axial displacement; that is, no eversion or inversion. Twenty-one cases have axial displacement, eversion or inversion.

18. Large development of callus, producing any serious inconvenience in any way: of 168 cases reported, 117 no incommoding callus. Thirty-nine cases callus which produced some disturbance.

19. How measurements were taken: of 127 cases reported, 123 measured from anterior superior spine to internal malle-

olus. Anterior superior spine to floor, 1 case; anterior superior spine to the tubercle of the tibia, 3 cases.

20. The amount of disability as estimated by: (a) endurance: 121 cases reported, 70 endurance good; (b) pain: 129 cases reported, 19 had pain; (c) swelling of foot or leg: of 130 cases reported, 15 had swelling; (d) interference with joint function: 148 cases reported, 15 had joint interference.

21. Mortality: 24 deaths, or 8.6 per cent. Cause of death: 4 pneumonia; 5 shock, aged; 1 shock and delirium, aged 64 years; 4 delirium tremens, aged; 10 various intercurrent diseases.

22. Was X-ray used: of 173 cases reported, 83 were X-rayed. What did it show as to results: 8 cases only reported good apposition without angulation. Many reporters failed to note this point, however.

Since the above report was made, the writer has collected other cases as follows:

1. Total cases, 482.

2. Ages: below ten years, 20; between 10 and 20 years, 22; between 20 and 50 years, 17; between 50 and 70 years, 17; between 70 and 90 years, none; between 90 and 100 years, none; cases not mentioned, 385.

3. Occupation: working people, 35; cases not noted, 446.

4. Cause of fracture: direct violence, 37; indirect violence, 443.

5. Seat of fracture: 83 cases has this noted; of these, upper third, 26; middle third, 41; lower third, 16.

6. Kind of fractures: simple, 463; compound, 6; compound comminuted, 6; complicated and multiple, 6.

7. Amount of shortening at time of injury (admission): of 458 cases noted, average shortening before reduction was 1 inch.

8. Method of treatment: of 190 cases noted, some form of Buck's extension, 66; plaster of Paris, 27; long lateral splints, 1; sand bags, 20; double inclined plane, 3; open method, 64; various form of splint, 9.

9. Anæsthetic: Yes, 34; no, 38; 409 cases not noted.

10. Extension, average amount of weight used: of 63 cases reported, 15 pounds was the average.

11. Effects of reduction on shortening as determined by measurements: recorded in only a few cases.

12. Amount of shortening: (a) 1 inch average; (b) $\frac{3}{4}$ inch average; (c) $\frac{3}{4}$ inch average; (d) $\frac{1}{2}$ inch average; (e) $\frac{1}{2}$ inch average; (f) $\frac{1}{2}$ inch average.

13. Length of time in bed: of 88 cases reported, average a fraction less than 9 weeks.

14. Length of time absent from work: of 70 cases reported, average a fraction less than 2.5 months.

15. Length of time crutches, cane, or other aids to walking were used: of 81 cases reported, average a fraction less than 8 weeks.

Note.—No. 15 was understood differently by various reporters, the answers varied very greatly.

16. Presence or absence of limp: of 107 cases reported, 81 limped.

17. Inversion or eversion of foot or tilting of pelvis, causing serious axial displacement: of 463 cases reported, 370 cases had no axial displacement; that is, no eversion or inversion; 93 cases have axial displacement, eversion or inversion.

18. Large development of callus, producing any serious inconvenience in any way: of 389 cases reported, 373 cases no incommoding callus; 16 cases callus which produced some disturbance.

19. How measurements were taken: of 60 cases reported, 48 measured from anterior superior spine to internal malleolus; anterior superior spine to the tubercle of the tibia, 12.

20. The amount of disability as estimated by: (a) endurance: 464 cases reported, 87 endurance good; (b) pain: 467 cases reported, 6 had pain; (d) swelling of foot or leg: 418 cases reported, 6 had swelling; (d) interference with joint function: 459 cases reported, 8 had joint interference.

21. Mortality: 3 deaths or 0.62 per cent. Cause of death: 1 exhaustion and shock; 1 uræmia; 1 hyperthyroidism.

22. Was the X-ray used: of 72 cases reported, 47 were X-rayed. What did it show as to results: 57 cases only reported good apposition without angulation. Many reporters failed to note this point however.

Tabulated with the 278 cases of last year's commission they appear as follows:

1. Total cases, 760.
2. Ages: below 10 years, 90; between 10 and 20 years, 65; between 20 and 50 years, 122; between 50 and 70 years, 55; between 70 and 90 years, 12; between 90 and 100 years, 1; cases not mentioned, 394.
3. Occupation: working people, 203; cases not noted, 479.
4. Cause of fracture: direct violence, 120; indirect violence, 619. Some cases are not reported. Probably many reporters misunderstood.
5. Seat of fracture: 278 cases has this noted; of these upper third, 63; middle third, 147; lower third, 68.
6. Kind of fractures: simple, 708; compound, 23; compound comminuted, 8; complicated and multiple, 12 cases; 9 not noted.
7. Amount of shortening at time of injury (admission): of 570 cases noted, average shortening before reduction was 1.38 inch.
8. Method of treatment: of 401 cases noted, some form of Buck's extension, 183; Scudder's splints, 24; plaster of Paris, 46; long lateral splints, 22; sand bags, 30; Hodgen's apparatus, 3; double inclined plane, 5; open method, 75; various form of splint, 12; no dressing, 1 case.
9. Anæsthetic: yes, 130; no, 181; 409 cases not noted.
10. Extension, average amount of weight used: of 210 cases reported, 14.0 pounds was the average.
11. Effects of reduction on shortening as determined by measurements: recorded in only a few cases.
12. Amount of shortening: (a) 1 inch average; (b) $\frac{3}{4}$

inch average; (c) $\frac{3}{4}$ inch average; (d) $\frac{1}{2}$ inch average; (e) $\frac{1}{2}$ inch average; (f) $\frac{1}{2}$ inch average.

13. Length of time in bed: of 294 cases reported, average a fraction less than 8.2 weeks.

14. Length of time absent from work: of 184 cases reported, average a fraction less than 2.7 months.

15. Length of time crutches, canes, or other aids in walking were used: of 179 cases reported, average a fraction less than 8 weeks.

Note.—No. 15 was understood differently by various reporters, the answers varied very greatly.

16. Presence or absence of limp: of 309 cases reported, 244 limped.

17. Inversion or eversion of foot or tilting of pelvis, causing serious axial displacement: of 620 cases reported, 506 had no axial displacement, that is, no eversion or inversion; 114 have axial displacement, eversion, or inversion.

18. Large development of callus, producing any serious inconvenience in any way: of 557 cases reported, 490 cases no incommoding callus; 55 cases callus which produced some disturbance.

19. How measurements were taken: of 197 cases reported, 171 measured from anterior superior spine to internal malleolus; anterior superior spine to floor, 1; anterior superior spine to the tubercle of the tibia, 15.

20. The amount of disability as estimated by (a) endurance: 585 cases reported, 157 endurance good; (b) pain: 596 cases reported, 25 had pain; (c) swelling of foot or leg: 548 cases reported, 21 had swelling; (d) interference with joint function: 607 cases reported, 23 had joint interference.

21. Mortality: 27 deaths or 3.69 per cent. Cause of death: 4 pneumonia; 5 shock, aged; 1 shock and delirium tremens, aged 64 years; 4 delirium tremens, aged; 10 various intercurrent diseases; 1 uræmia; 1 hyperthyroidism; 1 exhaustion and shock.

22. Was X-ray used: of 245 cases reported, 130 were X-rayed. What did it show as to results: 83 cases only re-

ported good apposition without angulation. Many reporters failed to note this point, however.

The writer's own cases treated in St. Luke's Hospital are 251—167 simple fractures, 84 compound, comminuted, or complicated.

Of the 167 simple fractures, 160 were discharged cured, average shortening $\frac{3}{4}$ inch, no inversion or eversion of the foot, nor was incommoding callus noted in any case. Five cases discharged from the wards with plaster splints or were treated in the outdoor department and finally cured. One case left the hospital without any union of the fragments. One case died of delirium tremens.

Of the 84 complicated cases, 63 were discharged cured, good functional results. Seven were sent to the dispensary for continuance of their treatment; were finally cured. Four sent away with apparatus, and union not complete, were lost sight of. Ten died; five of these had grave multiple injuries beside the complicated fracture of the femur, and were practically hopeless when admitted.

Not reckoning the cases of compound fractures which required operation but for which no direct fixation apparatus was used, there were 146 formal operations for the treatment of fractures by some fixation device applied directly to the bones themselves, or 7 per cent. of the fractures treated in St. Luke's Hospital. Of these 146 open cases but one died, or 0.68 per cent. This was a case of compound fracture of the forearm. It was infected before it came to the hospital and died of tetanus.

One hundred and twenty-one were cured, that is to say, their limbs were restored to good function and good cosmetic condition; two cases are marked "improved, sent to the dispensary." I presume these were also cured but I have no certain record of this.

There were 20 operations for direct fixation of fractures of the shaft of the femur. Fifteen of these cases were operations for fixation of fractures of the shaft of the femur only; 13 of these cases were cured and two improved. The two cases

marked "improved" left the hospital with some apparatus still on and were sent to the dispensary for supervision. They both made good recoveries. Two cases were operations for fixation of fractures of one femur and one humerus; both cases cured. Three cases were for fractures of one femur and one tibia, all of them cured. Eighteen were cured, two improved, no deaths.

Dr. J. B. Walker, of New York, in a personal communication informed me he had operated on 20 cases of fractured femur "with excellent results in every case." He reported no mortality.

Dr. F. W. Huntington reported seven operated cases with no death; since then he has had three more operated cases.

Dr. Sherman, of Pittsburg, reported seven cases with no death.

Dr. Vaughan, of Washington, D. C., in a personal communication reports 23 successful cases and mentions no death. These 60 cases with mine make 80 cases without a death.

While these statistics show that the mortality after open treatment of fractures need not be higher than that of the closed method, it is unquestionably true that the operations are sometimes formidable and very difficult undertakings.

The records of some other clinics do not show such favorable results however. For instance, I was informed by a leading surgeon that the mortality rate of open treatment in the clinics of a certain city was 25 per cent. This seems almost incredible, yet I think my informant was well posted and he is certainly an honest man.

A comparison with the overwhelmingly larger number of cases treated conservatively would obviously not be fair, but the records of these few operators indicate that open treatment for fracture of the femur can be done safely.

The most important matter, however, is, Do the older methods yield satisfactory results and may they be depended upon? The answer to that is, of 760 reported cases over 700 are reported to have made satisfactory recoveries.

Unfortunately, only a comparatively few of the reported

cases were checked and illustrated by radiograms. The ultimate position of the fragments was largely a matter of conjecture therefore.

As regards length of disability, there are too few operated cases to make a fair comparison.

The records of the reported cases are too irregular to satisfy many of the questions one would like to have definitely settled.

I shall therefore use the recorded cases from St. Luke's Hospital with which I am familiar. Every case of recognized fracture treated in the wards of St. Luke's Hospital the last two years has been X-rayed when the "setting" is supposed to have been accomplished, and when the union is complete. Also in nearly every case an X-ray negative is taken of the fracture before it is permanently dressed. This series of over 200 fractures shows in the radiograms what may be called perfect restitution of the fragments in less than 2 per cent., except in the operated cases.

The average shortening in completed cases of fractures of the shaft of the femur was $\frac{3}{4}$ inch.

Stiffness of the knee-joint, especially, has always occurred, but has never failed to yield to passive movements and massage.

Excessive callus and pain at the seat of the fracture has not been noted in any case of fracture of the femur.

Inversion or eversion of the foot has not occurred sufficiently to be marked or to interfere with locomotion.

Average disability 10 weeks.

In one case no union occurred. One case died.

As regards treatment, extension and counter-extension are employed in oblique fractures usually for four weeks, after this a plaster cast. We use a modification of Volkman's foot and leg splint to preserve the proper position of the foot and leg and to lessen friction of the mattress in the traction of the weight on the leg.

Apposition splints over the fracture are applied at such places as seem necessary to press the ends of the fragments into place.

Bardenheuer's transverse traction method has very rarely been used.

We prefer the early application of gypsum dressing (a cast) under complete anæsthesia for transverse fractures.

If the radiogram shows the bones in bad position, another attempt under ether is made to reduce them; if the second negative shows bad position still, the open treatment is employed.

In using traction we employ weight enough to overcome gradually the spasm and counter-pull of the muscles. In an adult from 16 to 25 pounds are necessary. Our modification of Volkman's splint makes sand bags and long lateral splints unnecessary in order to prevent inversion or eversion of the foot.

The Open Method.—In answer to direct inquiries regarding open treatment, 30 of the 35 surgeons who answered advocated this treatment early in case it was evident that proper restitution was not accomplished. Formerly surgeons advocated operative treatment only after several weeks of extension, splints, etc., failed to obtain union or satisfactory position of the fragments.

Three advocated the open treatment as the initial routine treatment. Only four surgeons were opposed to operative treatment in any case.

The writer himself operated on most of the 142 cases treated by the open method in his clinic. He has therefore had sufficient experience to know the difficulties in regard to accurate reposition and restitution of the fragments in the various kinds of fractures.

1. One difficulty, which may be removed by anæsthesia, is spasm of the muscles.

2. Another is locking of the fragments by leverage or gravity.

3. A third is the interposition of fascia, muscles, tendons, blood-vessels or nerves between the fragments. One always observes, and I have time and again pointed out to spectators and assistants, how difficult it is to disengage the ends of the

fragments from shreds of muscles and fascia which nearly always envelope them, even in an open wound. It must be quite impracticable in very many cases by the closed method.

4. The fourth difficulty is the shortening and overlapping which remains even after the spasm of the muscles which produced it is relieved by anæsthesia.

5. The last difficulty I would note is preserving the reposition of the fragments until a fixed, supporting dressing of some kind may be applied.

Difficulties numbers 1 and 2 are usually overcome by complete anæsthesia and careful manipulation.

The third difficulty, namely, covering of the ends of the fragments, and sometimes complete deviation of the fragments by some of the soft tissues, requires careful retraction, frequently curettage, always sufficient care and time completely to remove any shreds which would prevent the bones from coming actually in contact with one another. Anything which would result in the formation of fibrous tissue interposed between the ends of the fragments will jeopardize bony union and may cause a false joint.

The fourth difficulty, namely, to bring the ends of fragments into accurate apposition when they are overlapped, as they frequently are, an inch or more, usually is an extremely trying thing in the case of a fractured shaft of the femur. Manual traction on the foot and leg sometimes is quite inadequate, mechanical contrivances for traction are more efficient, but unless very carefully employed and supervised are apt to cause injury to the soft tissues to which they are applied. Direct manipulation of the fragments with Lane's forceps or Lowman's clamps without traction frequently fails. I have often used a lever after traction on the leg has drawn the lower fragment down far enough to insert the lever between the ends of the fragments. This does not control the fragments absolutely while the plate is applied, however. When the fracture is oblique the Lowman clamp is also uncertain in retaining the fragments immovably.

To overcome this difficulty, Dr. John Gerster, of New York

City, has recently devised what seems just the thing needed. It is a turnbuckle which should be used with a specially arranged pair of Lowman's clamps. These are a little heavier than the ordinary Lowman clamp and have a slot just in front of the shaft, so that a Lane or some similar plate may be slipped along the bone and adjusted over the fracture. One of the clamps should be applied to either fragment of the bone and should occupy the same relative position to each fragment.

As soon as the clamps are properly adjusted and the turnbuckle placed between them, an assistant should draw on the foot and leg, and when the end of the lower fragment is brought as far as practicable the extension is continued by means of the turnbuckle. While this makes the longitudinal adjustment, the clamps may be used to direct the lateral adjustment, or a strip of sterile gauze or bandage may be used for this purpose. This apparatus holds the fragments when adjusted rigidly in place until the plate is placed and screwed or pegged fast.

Dr. Edward Martin's suggestion of the use of a stout piece of muslin or canvas passed over the ends of the fragments for extension has the disadvantage of the likelihood of leaving shreds of cloth in the wound and over the ends of the bone; beside it requires a much larger wound to apply it than otherwise would be necessary.

The fifth difficulty may be overcome by the use of a plate placed over the fracture and secured firmly to the ends on either side.

In 1886 the writer devised a plate for direct fixation of fractured bones. It has been used in his clinic with good results ever since. It is a modification of the early Schede plate. It is made of soft steel, nickel plated. It has been known to bend a little but has never broken while in use. We use nickeled steel pegs, shouldered so as to press down firmly on the plate and hold it rigidly in place, and with a flat rectangular shaft which when in use projects through the soft tissues over the bone and by which the peg may be removed after union is sufficiently

advanced. The plate may be left indefinitely or removed at any convenient time.

Besides Lane's plates there are many other similar fixation devices. The operator may have a number from which to choose.

I must confess to a very strong dislike to any apparatus which will leave metallic substances within the bone itself. Undoubtedly it has been proved that the screws of Lane's device may remain within the lamellæ of the bone as far as the medullary cavity without producing any apparent evil. Still it must interfere with the nutrition of the bone, and to the extent that it does it proves harmful. In many instances the apparatus produces so much "irritation" long after union of the bone has occurred that it must be removed. I prefer therefore a fixation device which permits the easy removal of the screws or pegs which are driven into the bone. The plate may remain encapsulated over the periosteum without any harm.

No class of wounds or operations require such minute and complete aseptic details and preparations as these fixation operations on fresh fractures. Serious infection not only destroys the object of the operation, direct union of the bones without callus, but in every case jeopardizes the life of the patient.

The operations should be undertaken only by experienced surgeons whose aseptic technic is thorough and where all necessary instruments and apparatus may be had.

One feels confident, though surgeons have not reported except in a few instances their failures and deaths, that after these operations the percentages of deaths must be far higher than by the old conservative closed method.

SUMMARY AND CONCLUSIONS.

A study of the 760 tabulated cases of fracture of the shaft of the femur shows:

1. That records of fracture cases are kept very incompletely and that it is quite impossible in the United States

to obtain anything like full, accurate, and reliable data of a large number of finished cases.

2. The largest number of cases of fracture of the shaft of the femur occurs in men between the ages of 20 and 50 years. Children under 10 years of age have the next largest number.

3. Working people furnish the largest number of cases, though data in regard to this point are not kept in the majority of cases.

4. Indirect violence produces by far the largest number of these fractures.

5. The middle third of the bone is most frequently broken, the lower and upper thirds are almost equally involved, of the reported cases.

6. Simple fractures far outnumber the compound and complicated ones.

7. Average shortening before reduction 1.38 inch.

8. By far the most frequent method of treatment was by some form of Buck's extension.

9. An anæsthetic was not used to assist reducing the fractures in the majority of reported cases.

10. The average weight used in extension was 14 pounds. (This is too little weight.)

11. Not answered.

12. The average reported shortening of completed cases is $\frac{1}{2}$ inch.

13. Average length of time in bed, 8.2 weeks.

14. Average length of time incapacitated, 2.7 months. (This is probably a mistake.)

15. Average length of time crutches, canes, or other aids in walking were used, 8 weeks.

16. Limp was present for some time in the large majority of cases.

17. A little less than a fifth of the reported cases had inversion or eversion of the foot or tilting of the pelvis from serious axial displacements.

18. A little more than a tenth of the cases had excessive callus which produced some disturbance.

19. Nearly all the reported measurements taken were from the anterior superior spine of the ilium to the internal malleolus.

20. Disability estimated by (a) endurance, (b) pain, (c) swelling, (d) interference with joint function, present in about 1 case in 25 reported.

21. Death rate of reported cases, 3.69 per cent. (This I believe is a mistake.) Chief causes of death: (a) pneumonia, (b) shock and exhaustion, (c) delirium tremens.

It seems to the writer that there is no reason from the study of this much larger number of cases to change the form or wording of the conclusions adopted by the Commission of the Pennsylvania State Medical Society in its report of last year, and he offers these as his present deductions.

These incomplete reports, and the comparatively large number of cases which have been tabulated serve to indicate indubitably that this most important fracture and serious injury, in hospitals at least, does not receive the attention and care of the chief surgeons as a rule. Treatment is usually delegated to the interne staff, whose experience and anatomical and mechanical knowledge are wholly inadequate to meet the indications in a great many of the cases, and whose lack of order and thoroughness makes the records of the cases such unreliable data that it is very difficult for any one searching for the truth in the various phases of treatment to find what he wishes.

The first recommendation of the writer, therefore, would be, and the first deduction from his work is, that teachers of surgery in medical schools should give far more attention than they have done in the last decade or more to their own investigation of fractures, and to the teaching of this most important branch of surgery to the students who belong to their classes.

Second, while recognizing the fact that X-ray photographs may be most misleading, the writer believes nevertheless, when taken by competent anatomists who understand the importance of proper relative position of tube and limb, and the importance of taking more than one view of the fracture, these radiograms will furnish an indication for the proper reduction, and

the mechanical appliances for the preservation of proper apposition, and that they will serve as a graphic record of the fracture itself.

These radiograms to be most valuable should be taken before reduction of the fracture, when it has been reduced and has a fixed dressing, and finally after union has taken place and the patient is able to be up and about.

In regard to the method of treatment, the writer from the study of the cases finds that some form of traction is the method most commonly employed, and that the results after such treatment in most cases enables the patient to resume his occupation and function without serious detriment. Properly taken X-ray pictures however show that absolute apposition and restoration of proper axis of the bone is very seldom accomplished.

Deaths from simple fractures of the femur are 3.69 per cent. of the cases; the reports show they occur almost wholly in cases of old age from shock and exhaustion or from pneumonia; in drinkers from delirium tremens; or from some operative interference. It is evident that the open method itself introduces into the treatment of these cases such a very marked element of danger that the writer cannot recommend the method for general use nor recognize it as a routine practice.

In selected cases where it is impracticable to restore the fragments to their proper position, and where mechanical means have failed within a reasonable time to produce proper restitution of the fragments, the open method may be employed, but then only by an experienced surgeon, one who habitually employs most thorough aseptic methods.

The writer is not prepared to recommend any one method of mechanical treatment. As in everything else the method must be adapted to the case itself, and not the case to the method.

Some form of traction such as Buck's extension seems to be the preferable method of treatment. If Bardenheuer's suggestion of transverse traction over the ends of the fragments in

order to overcome lateral displacements be added, it will greatly improve the results in many cases. Hamilton's apposition splints placed about the fracture at proper places will serve for this purpose in the majority of cases.

Plaster of Paris is also a valuable means of treating these fractures, but it should be applied under anæsthesia. Complete relaxation, unconsciousness of pain, and laxity of muscle are necessary in applying the plaster dressing properly to these cases.

The usual methods of measurement are very inaccurate and give very misleading records in regard to shortening. This is all the more the case because of the well-established anatomical fact that femurs vary in length, and rarely are two lower extremities exactly the same. Records show good functional results after apparent shortening of extremities up to an inch and a half. The results may be considered good if the measurements show no more than an inch of shortening, provided there is no inversion or eversion of the foot from angulation of the fragments.

The ordinarily employed method of measuring from the anterior superior spine of the ilium to the tip of the internal malleolus should be checked as a rule by some other measurement, as for instance measuring from the tip of the ensiform cartilage to the internal malleolus or patella, or from the middle of the umbilicus to the internal malleolus. In making all measurements it is important to ascertain and assure if possible that the pelvis is not tilted and that the anterior spines are in the same horizontal plane.

My thanks are offered to the following surgeons who answered my questions in regard to fractures of the shaft of the femur: George E. Brewer, George S. Brown, Joseph D. Bryant, A. T. Cabot, Duncan Eve, F. H. Gerrish, John H. Gibson, M. L. Harris, Richard H. Harte, T. W. Huntington, August F. Jonas, Walter Lathrop, Robert G. LeConte, G. H. Monks, John C. Munro, Edward H. Ochsner, A. Primrose, Joseph Ransohoff, John B. Roberts, Charles Scudder, Harry

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SAFETY IN THE OPERATIVE FIXATION OF INFECTED FRACTURES OF LONG BONES.*

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ACCURATE fixation is fully as important in the presence of infection with fractures as it is in aseptic cases. Realizing that infection nearly always prevents any foreign body from healing in and becoming encysted, I have during the past year given some attention to the selection and employment of temporary apparatus for direct operative fixation, this apparatus to remain in the tissues only until plastic exudate would make it possible to retain satisfactory position after its withdrawal.

Since perfect drainage is a *sine qua non*, the operative wound should be treated without closure or suture of any kind. On the contrary it had best be packed as if an acute osteomyelitis already existed. This will act either as a prophylactic against the extension of bone infection, or in the event of spreading osteomyelitis being already present it will do what ought to be done in the circumstance, that is, it will secure the drainage of the soft parts and will tend to limit the septic process in the bones.

Obviously in these infected cases an intramedullary splint of any sort is contraindicated, and the use of a Lane's plate which assures the absolute reposition of the fragment has the drawback that the removal of the plate when it shall have done its work is an operation of considerable magnitude and no little danger.

The method described by Leonard Freeman in 1904 and again before this Association in 1911 in an essay on the fixation of oblique fractures of the tibia and other bones by means

* Read before the American Surgical Association, May 30, 1912.

of external clamps fastened to screws inserted into the small openings in the skin gave me a suggestive hint. As will be recollected Freeman makes use of two screws set in the bone after the reduction of the fracture and held in place by a clamp running parallel to the broken bone but outside the wound, the clamping bars being placed at the distal extremities of the screws.

Parkhill in 1898 and Lambotte in 1907 wrote on this subject and demonstrated various forms of clamps depending on screws inserted into the bones for their fixation points. Probably the pioneer in this work was Malgaigne.

Taylor, of Port Arthur, Ontario, published a method of fixation somewhat similar to that of Freeman. Taylor put drills into the bone before placing the fragments in position and regardless of alignment. The fracture now being reduced, these drills were held in whatever position they may have assumed by one or more steel bars, placed against their distal parts and held there by a mass of plaster of Paris, thus preventing all motion in the fractured part except a very slight amount which was unavoidable on account of the moderate flexibility or spring of the drills. It has been recommended by most operators to close the wound by suture or otherwise, or else to insert the screws through mere cutaneous punctures and to remove the fixation drills at a suitable time when some union is supposed to have occurred. Doubtless in closed uninfected fractures this method would be quite proper.

During the past year I have made trial of a modification of these methods in six fractures of the long bones, four of which were closed or simple fractures and two open and more or less infected ones. The results on the whole were good as to healing and function. One case, however, in an alcoholic man with fracture of the radius, became infected and there followed some disability because of suppuration between the muscles of the forearm. I have applied the method in fractures of the tibia, the radius, the ulna, and the femur, no case being operated upon until conscientious attempts at reduction had failed. The method which I have used is one which is

extremely simple in its technic and requires such ordinary tools for its successful application that I believe it deserves further trial in suitable cases.

Having exposed the fracture and a sufficient amount of bone above and below it, an ordinary gimlet of a size to fit the case is screwed into one of the fragments at right angles to the long axis of the bone. This gimlet should be fairly close to the fracture but not near enough to endanger the bone by splitting. A second gimlet is now placed an inch or so above the first one. Two other gimlets are similarly screwed into the other fragment about the same distance from the fractured end as were the first two. The gimlet should wedge firmly into the bone so that there will be no play on gentle attempts at motion. It is not necessary to pay attention to alignment. The gimlets being in place, reduction is effected under the eye and the bone held in proper position either from without by an assistant or more directly with the aid of bone clamps. Now two pieces of steel rod about the thickness of small telegraph wire are applied in such a way along the line of gimlets and roughly parallel to the bone that the rods and gimlets shall be in contact. If the gimlets were in a perfectly straight line one rod would be sufficient, for it would touch all of them; but the line being a staggering one, two rods will be found necessary. The rods are to be placed rather far from the wound toward the heads of the gimlets. The rods and gimlets are now bandaged solidly together with a few turns of plaster-of-Paris bandage, previously sterilized by baking. In a few minutes the plaster will have set and the rods and gimlets will be one rigid mass, naturally holding the parts in the position in which they were when the plaster set. It will be found that the bone fragments will be held in alignment by this mass of plaster of Paris, rods, and gimlets.

The wound is now disinfected and packed to the bottom with gauze, and a light rigid dressing applied. At the end of two or three weeks the gimlets will have worked loose because of slight motion and osteoporosis adjacent to the metal and may be easily and painlessly removed, the case from now on

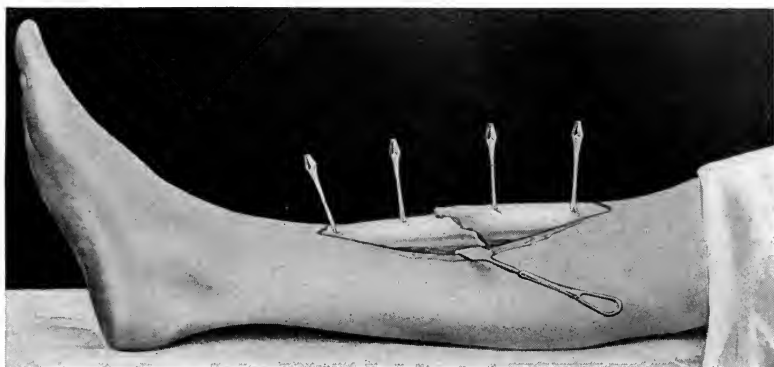
being treated as an ordinary open fracture. The gimlets which proved most satisfactory for this purpose are the ordinary square-headed variety which fit in a brace or which can be put in with a key. If at the end of two or three weeks when the gimlets are removed the wound is found to be aseptic, it may be closed with adhesive strips or sutures. Otherwise open treatment as for any infection should be pursued.

Realizing that a fixation bar or plate transmits its rigidity in inverse ratio to the distance of the plate from the bone, and that when the plate or bar is in contact with the surface of the bone rigid support will be most accurate and that for this reason the Lane plates or their modification are mechanically more perfect than the method I have described and employed, I have devised a modification of the plating method which will combine, it is hoped, the excellent mechanical features of Mr. Lane's beautiful device without the necessity for the removal of the plates in infected cases, an operation of some magnitude.

In other words I wish to present an easily removable modification of the Lane plate and screws (Fig. 8). It will be noted that at the end of the plate there is a little prolongation which is perforated to hold a stout wire. This prolongation is also filed on the bone side of the plate to form a groove so that the wire will not be compressed between plate and bone. The screws and the cone shape of their heads are similar to the Lane screws, but the head is prolonged into a steel shaft of from three to five inches, terminating in a square pyramidal head to fit a key which is to be used instead of the screw-driver. All the steps of the operation of plating a fractured bone will be the same as described by Mr. Lane, excepting that no screw-holder or screw-driver need be used, and that a silver plated piece of piano wire threaded into each terminal aperture in the plate will project from the wound, and that naturally these extension screw heads will also project from the wound.

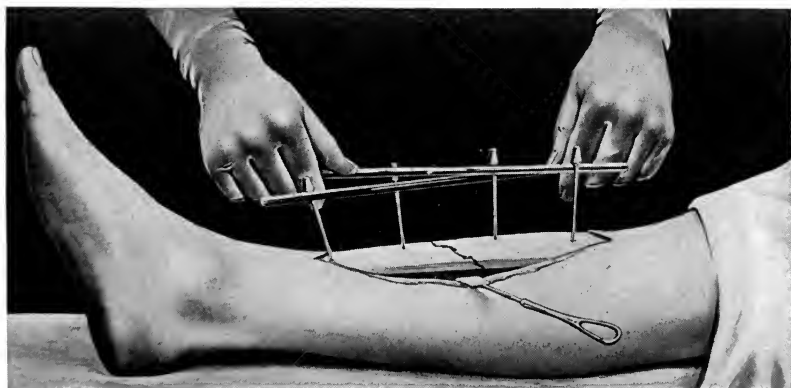
This method being in use for infected fractures, the wound itself will be packed or otherwise drained. After a suitable

FIG. 1.



Gimlets in place; fracture not in alignment.

FIG. 2.



Bones in alignment; bars and gimlets in final adjustment.

FIG. 3.



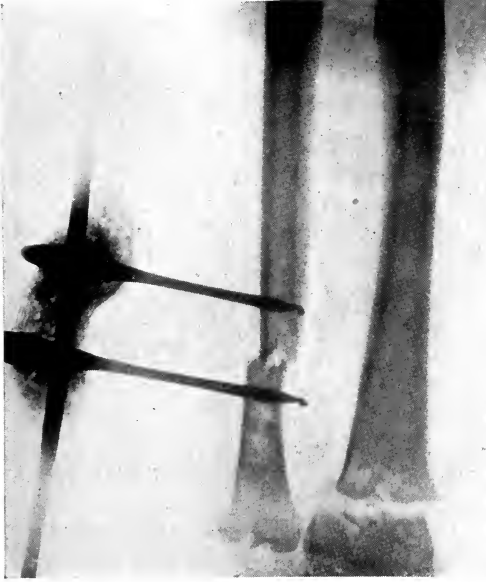
Gimlets and bars being fixed with plaster-of-Paris bandage. Wound packed with gauze.

FIG. 4.



Fragments held in perfect apposition by two gimlets. (Case II.)

FIG. 5.



Gimlets applied to ulna. (Case III.)

FIG. 6.



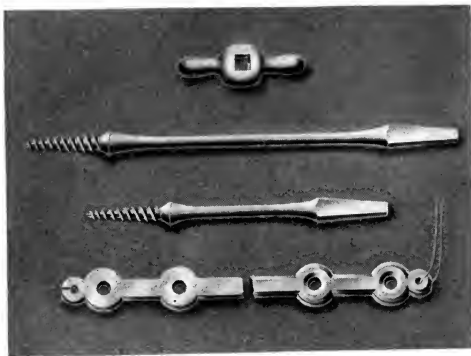
Before operation, but after attempted reposition. (Case IV.)

FIG. 7.



Slight bowing, but perfect function. (Case V.)

FIG. 8.



Author's modification of plate and screws.

lapse of time, say from two to four weeks, the screws are to be removed with key or wrench and the plate is to be drawn from the wound by one or the other wire. It is expected that some force may be required for this procedure, but it is probable that the removal of the plate will be infinitely easier and speedier by this method than by an operation which means free exposure of the parts, the removal of firmly seated screws with a screw-driver, and the extraction of the plate with forceps. I repeat that it is expected that this form of plate is intended for use in infected fractures only, although it may be found on further trial that the removable apparatus may prove of value in cases not frankly infected but merely suspected at the time of operation.

In a recent conversation with Dr. Garrow, of Montreal, he gave me the history of a fracture of the femur occurring apparently through weakness of the bone due to the presence of screws in a case of a completely healed fracture which he had treated by a plating operation. The patient was a young boy and the second fracture occurred some weeks after he had been discharged from treatment. The occasion of this new fracture was a twist of the limb by a sudden turning of the body and the break occurred not at the point of original fracture but at one of the screw holes.

Now, while the plate is of tremendous value in holding firmly and accurately together the fragments of a recent or ununited fracture, it is self-evident that the mere presence of the screws in the shaft of a long bone must prove a source of weakness, because they mean the persistence of bony defects. With the screws removed these defects would fill with new bone and osseous homogeneity would be restored.

To conclude: In this paper I have tried to emphasize (1) the necessity for full drainage in all septic or suspicious fractures of long bones; (2) I have tried to demonstrate the possibility of the direct operative fixation of infected fractures while securing the necessary drainage; (3) in infected fractures direct fixation by apparatus should be temporary.

ABSTRACTS FROM CASE HISTORIES.

CASE I.—George C., forty-nine years old, admitted to Bellevue Hospital August 3, 1911. Compound fracture of both bones of the leg about two inches above the ankle. Repeated attempts at reduction were vain. Operative fixation of the tibia by the gimlet method. August 24, the gimlets were removed. Afebrile recovery.

CASE II.—Louis N., forty-seven years old, was admitted to Bellevue on September 1, 1911. Fracture of his left radius at the middle third. The fracture could be reduced but could not be held. Operation by gimlet method. One gimlet in each fragment. Apparatus removed on September 19, when the wound was clean, after that infection and deferred healing. Final union.

CASE III.—Margaret R., fifty-three years old, admitted to Bellevue on September 15, 1911. Compound fracture of the lower part of the right radius and ulna. An X-ray three days later showed poor position after supposed reduction. Five days after injury gimlet operation on the ulna by Dr. Burdick at my request. Wound left open. Gimlets removed on October 3, and patient discharged October 13 well, but with a small healthy granulating wound.

CASE IV.—Samuel W., twenty-three years old, was admitted to Bellevue Hospital September 7, 1911. Fracture of femur at junction of lower and middle third, about an inch and a half over-riding. Extension failed and gimlet operation performed one week later, using one gimlet in each fragment. An X-ray five days later showed recurrence of the over-riding through rotation of the gimlets in the bone. A secondary operation was done and two gimlets were now placed in each fragment. Aseptic healing and excellent result.

CASE V.—Peter F., age ten years, was admitted to Bellevue Hospital August 24, 1911. Right thigh fractured in the middle third and over-riding as shown in Fig. 7. Operation September 2, 1911, extension having failed. September 21, gimlets removed. Patient made an uninterrupted recovery.

CASE VI.—Louise G., six years old, was admitted on August 11, 1911. Fracture of the fibula and the tibia in the lower third. Reduction and plaster-of-Paris dressing. X-ray showed poor position. August 24, operation by gimlets. Wound sutured be-

tween the gimlets. September 9, apparatus removed. Wound healed October 1, when patient was discharged well.

NOTE.—On May 20 of this year I had my first opportunity to employ the modified plate and screws which I have described in this paper. The patient was a laborer 26 years old, who had been admitted to Bellevue Hospital the day before suffering from a compound fracture of both bones of the right leg. There was a good-sized wound through which the tibia protruded. Reposition by manual effort was possible, but alignment was difficult to maintain on account of slipping of the fragments. The operation of plating was surprisingly easy, mainly because the screws could be sent home by a simple twisting motion without the slightest pressure. In using a screw-driver a certain amount of pressure is necessary in order to keep the instrument in the slot of the screw. I was astonished to note how easily and yet how solidly the long shanked screws seated themselves.

On May 22, another patient, a man 40 years old, presented himself with a compound fracture of both bones, the tibia being broken about an inch and a half above the malleolus. On May 23, I operated upon this man by the same method and was again delighted with the ease of its application. The first operation was finished in about 20 minutes, and the second in about 15 minutes. Both patients are convalescing comfortably.

I would suggest that in plating operations on subcutaneous bone the screw shanks might be made very much shorter and the idea has also occurred to me that in simple and aseptic cases in which it is desirable to follow the original method of Mr. Lane and allow the plate to heal in aseptically, the screw might be made with a square head to fit the key but without the shank.

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INTRATRACHEAL INSUFFLATION ANÆSTHESIA (MELTZER-AUER).*

OBSERVATIONS ON A SERIES OF 216 ANÆSTHESIAS WITH THE ELSBERG
APPARATUS.

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INSUFFLATION anæsthesia administered with the Elsberg apparatus has been employed in 216 cases, in the Second Surgical Division at the Roosevelt Hospital during the past year.

It has been used in a great variety of conditions, in many of which we believe it has special advantages, while in others it is probably no better than other forms of anæsthesia.

I will mention briefly some of its advantages:

1. Even and sufficient oxygenation and ventilation of the lungs with no possibility of obstruction of the upper air passages.

2. Prevention of the inhalation of blood, mucus, vomitus, or other foreign substances into the larynx or trachea by the return current of air around the tube. This is of especial value in operations about the mouth and pharynx. It has made the greatest difference both in the ease of the operation and in the absence of post-operative pneumonia or bronchitis. In the series, among other cases of this type we have had three excisions of the superior maxilla, two cleft palates, one partial excision of the tongue, and one sarcoma of the ethmoid.

The blood and mucus may be sponged from the pharynx at leisure, with the assurance that the return current of air around the tube will absolutely prevent any from entering the pharynx.

* Read before the American Surgical Association, May 31, 1912.

3. Positive pressure to any desired degree, when one or both pleural cavities are opened by accident or design during the operation, thus eliminating the danger of pneumothorax.

It is my belief that it will supplant both negative and positive pressure cabinets, as it has the great additional advantage of thorough ventilation of the lungs, automatically secured, without reference to the patency of the upper air passages. We have had 12 thoracic operations, mostly empyemas, so that our experience with this phase of the subject is too limited to be of much value, though it has proved most satisfactory in all of our cases.

4. In operations about the head and neck the anæsthetist is out of the way, the field is more easily protected and kept sterile, and above all difficult breathing and obstruction of the upper air passages from various reasons is absolutely eliminated.

In goitre cases and prolonged dissections of glands of the neck it is especially useful.

5. Absolute relief of all strain upon the respiratory apparatus, and consequent relief of much strain and harmful effect of the anæsthesia on the cardiovascular and the central nervous systems. This prevention of the unconscious struggle of the respiratory apparatus against obstruction in the upper air passages and insufficient oxygenation with cyanosis is to my mind one of the most valuable features of the method.

One must needs watch a number of these cases and see the quiet, natural respiratory movements, the good color and peaceful appearance, the steadiness in rate and quality of the pulse through prolonged and difficult operations and in debilitated and feeble patients, to appreciate what this means.

6. Less operative shock: The marked absence of operative shock in the cases of this series is suggestive that in estimating the relative influence of the anæsthetic and operative trauma, too little has been attributed to the former. We are firmly convinced that operative shock, especially in the long and difficult cases, is appreciably less with insufflation anæsthesia.

7. Light anæsthesia: It is practically impossible to over-anæsthetize by this method given with the Elsberg apparatus. The fault if any is on the side of too light anæsthesia. It is a great comfort to the operator in critical cases to feel that with the even, mechanical delivery of ether vapor and air into the lungs, the dangers of over-etherization and insufficient aëration are absolutely eliminated, for this in itself insures the minimum of strain on the circulation and of shock to the central nervous system from the anæsthetic. A few minutes before the operation is finished, the ether vapor is shut off and pure air is insufflated, blowing out all remaining ether vapor from the lungs, and hastening the recovery of consciousness.

8. Safety of the method. We have found the method absolutely safe and have seen no harmful results of any consequence in the cases of this series. It is not fool proof, however, and certain cardinal principles must be thoroughly understood and carefully guarded in its administration. These will be referred to in discussing the technic and the difficulties and defects of the method.

Intubation.—The patient must first be anæsthetized in the usual way and fairly well relaxed, to prevent movements of the pharynx and laryngeal spasm while intubating. The procedure is difficult in a small percentage of cases. It is done through the Jackson direct laryngoscope, the head hanging over the end of the table and supported by an assistant. A silk elastic catheter, No. 24 F., is the size used for the average adult. It must be firm enough to hold its direction and not sag downward, or it will enter the œsophagus. It should be marked at 26 cm. and not inserted farther than this point from the incisor teeth. The tip is then one to two inches above the bifurcation of the trachea (Elsberg). In adolescents and small adults the catheter should be smaller in calibre, *e.g.*, 22 F. to 18 F., *i.e.*, its diameter should not be greater than half the diameter of the glottis. No. 26 F. is occasionally used in very large adults. A good view of the vocal cords should be obtained through the laryngoscope, before any

attempt is made to pass the tube. We have found that when one man has failed to intubate after several attempts, another, no more skilful, will often try and succeed at once. Soreness of the pharynx and pain on swallowing has been caused in a few cases by direct trauma from the laryngoscope after repeated attempts in difficult cases. In a few cases (7 or 8), mostly in our early cases, we failed to intubate, giving up the attempt rather than prolong the preliminary anæsthesia and traumatize the pharynx. When the tube enters the larynx there is usually a characteristic sound in expiration, which means a successful intubation. In light breathers this is not always the case and several times we have passed the tube into the œsophagus, without recognizing it until the current of air was started. Generally the expiratory current of air through the tube can be detected by a little fluff cotton held near it, by holding the tube near the cheek, or near the surface of water in a small cup or glass. The movement of the mercury in the manometer with respiration is also a guide but not infallible. Sometimes in spite of precautions it is found after the current is started that the tube is in the œsophagus. By exposing the upper abdomen and watching the epigastric region, the distention of the stomach is readily detected in a few moments, belching of air occurs with a characteristic sound, the tube is disconnected immediately but not withdrawn until gentle pressure over the stomach has forced out the air, and the intubation is repeated. This precaution should always be taken when the position of the tube is in doubt. No ill effects have ever been seen by us from this mishap, but it is quite possible that carelessness might bring about over-distention of the stomach and a harmful result.

The intubation is done, and the anæsthetic administered by my hospital internes, all of whom become proficient in the method in a surprisingly short time.

We have tried the Boothby-Cotton curved intubator with little success, and agree with Elsberg, who has experimented

with various devices, that the direct laryngoscope is the best method tried up to the present time.

Over-pressure.—A cardinal principle of the method is that the degree of pressure should always be carefully watched and absolutely under control. The average pressure in the tube during anæsthesia is 18 to 25 mm., being much less of course in the trachea and bronchi. It may be increased to 35 or 40 mm. without danger in difficult cases, anything below 50 to 60 mm. being considered by Meltzer to be absolutely safe. Every minute or two it is reduced to zero for a moment by opening a stop-cock, to allow the lungs to deflate. The anæsthesia should never be continued if the manometer is out of order, or for any reason the exact pressure is not known and under control. It is well to have a safety valve attached to each apparatus.

Insufficient Anæsthesia.—In alcoholic robust adults it may be impossible to secure a sufficient degree of anæsthesia to relax the muscles or even to keep the patient quiet enough to proceed with the operation. In three cases it had to be abandoned on this account; in seven others it was troublesome, but not enough so to seriously impede the operation. In the remaining 206 cases, the anæsthesia was satisfactory and relaxation good.

A preliminary hypodermic of morphine $\frac{1}{4}$ gr., atropine 1/150 gr., which we now give as a routine to all robust adults, aids in securing a satisfactory degree of anæsthesia. Proper regulation of this dose should make good anæsthesia and relaxation possible in all cases.

Cough.—In a few cases this is troublesome when the ether vapor is turned on. If the tube is inserted too far, its tip irritating the tracheal or bronchial walls near the bifurcation, withdrawal for an inch or so will often stop the cough. If this fails and the cough is due to too light anæsthesia, increasing the strength of the ether vapor and raising the pressure somewhat may be effective.

Hiccough.—Hiccough was present in two cases, in one for a short time at the beginning of the anæsthesia, in the other

throughout the operation. In neither was the operation interfered with.

Vomiting was present in 51 of the 216 cases, 23.6 per cent. It was slight in 29 cases, moderate in 18, severe in four. All of the latter were severe abdominal cases vomiting prior to operation.

The method was used once in a case of stricture of the larynx, the tube being passed through a tracheotomy wound and anæsthesia induced without preliminary etherization. There was some cough and it took about twenty minutes to get the patient under the anæsthetic.

We have used the apparatus for resuscitation in a case brought into the emergency ward, deeply cyanotic, gasping infrequently, pulseless at the wrist, and apparently dead before the intubation was completed. In a few minutes the cyanosis disappeared, respiration was re-established, and in less than half an hour the patient was sitting up in bed quite over the attack. Examination then showed a large thoracic aneurism, and three days later the patient died in a similar attack, the insufflation this time proving ineffective.

After-effects.—In regard to after-effects, the most natural to fear are pneumonia or bronchial irritation.

Pneumonia: There has been no ether pneumonia in the series. Two patients had post-operative pneumonia, but in neither could the anæsthetic be held responsible. One, an obese, debilitated old man on whom suprapubic prostatectomy was performed, developed a late, hypostatic pneumonia some days after the operation, which finally subsided and a good recovery followed. The other case, operated upon for perforated duodenal ulcer, peritonitis, and general sepsis, desperately ill at the time of the operation, ran a long course of sepsis from which he finally died, of which a right lower and middle lobes pneumonia was one of the manifestations. After a careful consideration, we did not feel that the pneumonia in this case could in any way be charged to the anæsthetic.

During the period in which we have been using insufflation

anæsthesia, we have had four or five ether pneumonias on the Division, but all in cases in which other methods of anæsthesia were used.

Bronchitis: There have been no cases of ether bronchitis. In a few cases with slight bronchitis at the time of operation, there was little if any increase of the cough, none developing any decided aggravation of the condition.

Laryngitis: There has been no post-operative laryngitis or hoarseness.

Pharyngitis: This has been noted in seven cases. In three there was marked discomfort and difficulty in swallowing for from one to three days. In one case in which the attempt to intubate was abandoned after a prolonged trial, the soreness persisted for a week. Difficult intubation and direct trauma to the pharynx and epiglottis with the laryngoscope was the cause in all of the cases. In none was the result anything more than a few days of discomfort.

Injury to teeth occurred in three cases: in one an incisor tooth loosened, in the other two some fragile bridge work was broken.

In a series of 216 cases, we have considered the method of special advantage in many cases, some of which I will mention, viz.:

| | Cases |
|---|-------|
| Goitre | 5 |
| Exophthalmic goitre | 4 |
| Tuberculous glands of neck | 25 |
| Resection of superior maxilla | 3 |
| Sarcoma of ethmoid (2 hours) | 1 |
| Cleft palate | 2 |
| Excision of tongue | 1 |
| Pyopneumothorax (following bullet and stab wounds of lungs) | 2 |
| Old empyema, abscess of lung | 6 |
| Subphrenic abscess | 3 |
| Miscellaneous operations about the head and neck..... | 13 |
| Operations upon the breast | 9 |
| Prostatectomy | 5 |

It has also been employed in 68 abdominal operations, including many desperate and difficult cases in which the quiet

and even anæsthesia, with absence of anæsthetic shock and depression, has been a great comfort to the operator and added element of safety to the patient. One case, a very obese woman with ventral hernia, strangulated for four days, with fecal vomiting and practically pulseless at the wrist on admission, died on the table, but was in no sense a death from the anæsthesia, as pure air and not ether vapor was used the greater part of the time during the forlorn attempt to relieve the condition.

In some cases of acute intestinal obstruction and diffuse peritonitis with profuse vomiting before and during operation, it has been of value in preventing the inhalation of vomitus, as well as in giving even, quiet anæsthesia under the most trying conditions.

There have also been 13 operations on the kidney and ureter, in which, on account of the awkward position, the anæsthesia has been much less troublesome than with the routine method.

CONCLUSIONS.

1. Insufflation anæsthesia is safe if certain cardinal principles are observed in its administration, *i.e.*, one must guard against over-pressure, spraying of liquid ether through tube, introduction of tube into œsophagus, introduction of tube beyond bifurcation of trachea, and trauma to pharynx or larynx in intubation. A proper apparatus and ordinary caution should absolutely prevent the accidents which have been responsible for the few reported deaths from the method.

2. The uniformly sufficient aëration of the lungs, with the even administration of well-diluted ether vapor, relieves the respiratory apparatus and central nervous system of much strain, and over-etherization is impossible.

3. The prevention of the inhalation of blood, mucus, or vomitus, especially in operations about the mouth and pharynx, is an important feature in preventing inhalation pneumonia or bronchitis, and in making such operations easier and more rapid.

4. Operations about the head and neck are made much easier, as the anæsthetist is out of the way, the field is easily kept sterile, and above all obstruction of the upper air passages is eliminated.

6. The insufflation of pure air at the end of the operation makes recovery of consciousness prompt, and disagreeable ether after-effects are reduced to a minimum.

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ORIGINAL MEMOIRS.

THE VALUE OF DIRECT GASTRODUODENOSCOPY IN AFFECTIONS OF THE STOMACH AND THE DUODENUM.*

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EVEN with a thorough application of all the modern methods for examining the stomach as regards its chemical function and its motility, and of the methods for examining the contents of the stomach and the fæces for blood, there yet remain a number of cases where the diagnosis of the nature of a stomach disease or the differential diagnosis between a disease in the stomach and a disease in the duodenum is indefinable. In order if possible to arrive at a diagnosis in such cases without operating, one has worked for many years to develop a method which will bring the affected part within range of one's vision. The oldest of these methods is the so-called diaphanoscopy: the illumination of the stomach and abdominal wall by means of a glow-lamp introduced into the stomach through the œsophagus. When the patient is placed in the dark, the illuminated stomach is seen shining through the abdominal wall, and a large tumor or infiltration should reveal itself as a shadow against the light. This method, the

* Read before the American Surgical Association, May 31, 1912.

idea of which originated with the French doctor Milland in 1867, as a result of his experiments on cadavers, was first attempted by Einhorn in 1889, and was employed in his clinic but has never had any great significance, for reasons which are easily understood. First, it shows only those gross abnormalities which can easily be diagnosed in other ways, and, second, only the very small part of the stomach which is not covered by the liver and chest wall can be seen. One has formed great expectations as to the efforts to construct a gastroscope on the same lines as the cystoscope for introduction through the œsophagus. Since 1881 Mikulicz and his pupils have worked energetically to solve this problem, and have indeed succeeded in constructing instruments whereby one can observe through a long tube a portion of the mucous membrane lighted by an electric lamp, but they have never succeeded in making these really practicable, partly because it is very difficult to insert this large instrument, as great practice on the part of the doctor and gradual habituation on the part of the patient are required, notwithstanding the use of very strong solutions of cocaine, and partly because the field of vision is too small and a survey in all directions is unattainable. Where the diagnosis is uncertain and medical treatment ineffective, we must resort to explorative laparotomy. As a rule, the inspection and palpation of the exposed stomach give us at once the diagnosis, so far as this is needful to define our therapeutic encroachment; but it cannot be denied that a no small number of cases remain, where this examination leaves us just as much in doubt as we were before: cases where we do not know whether an ulcer is present or not; others where we know that there must be an ulcer because of symptoms of hæmatemesis and melena, though we can neither feel nor see it; and others again, where indurations in the serosa or adhesions cause us to suspect the presence of an ulcer, though this might be due to other causes; and cases where we find an infiltration of the wall, but do not know whether this is a tumor or an inflammation infiltration. We understand how important, how absolutely necessary indeed, it is to have all possible information, in order to avoid

a fatal mistake in the treatment and in the choice of operation: whether a safe encroachment like gastropexy is sufficient, or whether a gastro-enterostomy, or possibly a resection of the stomach, is called for. A mistake in the choice of operative methods, founded on a doubtful diagnosis, is responsible for the evil results of many operations.

In order to avoid these mistakes, I have devised a method of examination, which in most cases has proved capable not only of clearing one's doubts, but which is moreover so simple and easy in its technic, that every surgeon can easily avail himself of it. I have called this method direct duodenogastroscope and diaphanoscope. My gastroscope is an instrument constructed like Nitze's cystoscope, though much larger, as it corresponds with Charriere's Nos. 39, 40, while the cystoscope corresponds with No. 21. Thus we obtain a far stronger source of illumination, and, what is of more importance, an enlarged field of vision. On the front of the tube runs a flat canal, which terminates at the fenestrum with a transverse fissure and opens upward into a projecting, tap-provided, small, bent tube, which is connected with an insufflator by a rubber drain. The entire apparatus is sterilized in formalin vapor, and held in readiness at the operation. If the diagnosis is doubtful, I make a small incision midway in the stomach, 2 cm. above the great curvature, and just large enough to permit the instrument to pass. In this way it is not necessary to make a tobacco-pouch suture to close the stomach wall tightly. As soon as the instrument is inserted, an assistant begins to inflate the stomach with air—by compressing the inflator—until all creases are effaced. The lamp is lighted and the large sterilized blind lowered, so that the room is in darkness. One sees the stomach shining like a large electric lamp, and one sees all anatomical details revealed in its wall with wonderful accuracy. With a normal stomach one sees the larger vessels of the greater and lesser curvatures straining toward each other with continuously dichotomous ramifications in the clear, somewhat rose-colored stomach wall, but one does not see them meet. The course of the muscle fibres in the various layers is seen

with the greatest distinctness, while the crypts evince themselves as small, whitish dots. A disease which is at once revealed by diaphanoscopy is gastritis in its various stages; because the stomach wall is then diffusely red, from strong rose to deep, bluish red; and while with the normal stomach one only sees the larger vessels aiming for the centre, here we see them connected by a more or less profuse plexus.

When there is no ulceration or gastritis, tumors are depicted as dark, diffuse shadows on the otherwise clear stomach wall. This was well illustrated in a case in which there was a tumor which had not betrayed itself clinically by any other symptom than *achylia*. At the operation, which was undertaken for a small hernia lineæ albæ, a flat infiltration of the anterior stomach wall was discovered, the nature of which could not be decided until diaphanoscopy and gastroscopy proved it to be a flat non-ulcerating tumor. Immediate resection of the stomach was performed, and the patient recovered. The tumor was an adenocarcinoma.

In strong contrast with this is the picture of the deep, chronic ulcers, which are distinguished by the centrally decayed and cicatrized part showing itself as a porcelain-like, whitish spot with a paucity of vessels, contrasting sharply with the surrounding red, hyperæmic part. If, on the other hand, small superficial ulcers of the mucous membrane are concerned, these are not revealed by diaphanoscopy, but are first discovered by surveying the mucous membrane through the gastroscope. Only when they are hemorrhagic, bleeding, or covered with coagula, does one see them depicted as dark spots on the wall, and when such a sore bleeds, one sees the stream of blood as a dark stripe pursue its way toward the greater curvature.

In order to inspect the hinder illuminated surface of the stomach thoroughly, the omentum and colon transversum must be raised. When one has illuminated the stomach, the gastroscope is led through the pylorus into the duodenum. Should there be the smallest difficulty in passing the gastroscope through the pylorus, one knows that there is a contraction of this. The wall of the duodenum, which is far

thinner than that of the stomach, can be illuminated more strongly and more satisfactorily, and a tumor or ulcer can be easily discerned.

It is seen what a surprising amount of information we can obtain from this illumination of the stomach. Often we obtain the complete diagnosis: gastritis, ulcer, or tumor. In most cases it is a valuable guide to the subsequent gastroscopy, because one immediately turns one's attention to that feature which the illumination shows to be abnormal. And, if one is then in doubt as to whether a shadow is due to an ulcer, a tumor, or an extravasation of blood, a direct observation through the gastroscope will provide a complete elucidation. The view obtained through the gastroscope is far better, sharper, and more certain than that given to the bare eye by an examination of the opened stomach, not only because the view is considerably enlarged and the illumination greatly intensified, but also because, when the stomach is inflated, all the folds, between which a small abnormality is so easily concealed, are smoothed out and made freely accessible to the investigator. With this gastroscope, therefore, one can make a systematic inspection of the entire mucous membrane of the stomach and of the top portion of the duodenum in the course of a few moments. The normal mucous membrane of the stomach shows itself in the gastroscope as a smooth, rose-colored surface, which merges at the cardia and pylorus into radially placed folds, which tend funnel-shaped toward the circular opening. Any abnormality in these two openings is shown in a very characteristic manner. If the pylorus is annularly infiltrated or contracted, one sees a stiff, yawning circle, through which one often obtains a glimpse of the duodenum; if only half of the pylorus circle is infiltrated, this becomes crescent-shaped because the soft mucous membrane on the sound part caves in to the rigid half. Ulcerous formations in the pylorus itself are easily detected, but the folds of the mucous membrane round the pylorus require more exact attention. In those cases where the cardia was abnormal, the gastroscope showed an extraordinarily satisfactory and dis-

tinct view of the tap-shaped, ventricle-prominent cancer of the cardia, and of its ulcerating attacks on the neighboring portions of the mucous membrane of the stomach.

With cases of ulcer and cancer, gastroscopy is of value when the main features of the diagnosis are assured, because it defines precisely the limits of the mucous membrane affections. It is of even more importance because it so often clears up doubtful points which the diaphanoscopy has left unsolved. In this way the gastroscopic picture has in many instances shown ragged, tumor substances in the mucous membrane, which left no doubt as to the malignant nature of the infiltration, when we imagined that a simple ulcer tumor was present. What seems, however, to be of the greatest importance, is that in a series of cases gastroscopy has proved the presence of ulcers which could not have been substantiated in any other way. This is particularly applicable to the duodenal ulcers and to the small, bleeding ulcers in the mucous membrane of the stomach.

Great appreciation and much gratitude are due Moynihan and Mayo for their work on *ulcus duodeni*, but just as certain as it is that these surgeons are correct in stating that *ulcus duodeni* occurs far more frequently than was formerly suspected, just so certain is it that the frequency with which they substantiate this disease does not accord with the facts. The explanation is, that Moynihan overshoots the mark in thinking that he can diagnose solely from the pains and from the seat and character of these.

On the one hand my experience comprises a series of cases where the patient, who presented Moynihan's typical complex of symptoms in such a way that no one doubted that it was a question of *ulcus duodeni*, proved with gastroscopy to be suffering from *ulcus ventriculi* or *gastroptosis*, while the duodenum was found to be completely normal.

On the other hand the gastroscope has in 12 cases demonstrated an ulcer in the duodenum, the presence of which was not to be suspected from the symptoms and could not possibly have been substantiated without the aid of the gastroscope.

I must very particularly discourage the diagnosing of ulcer from the fact that one finds at the inspection inspissation or whitish spots or strings adhering to the serosa, as these are generally due to external abuses: foldings and bends, and the distention of the peritoneal duplicature. It is especially with patients who are not afflicted with ptosis, where the duodenum lies deeply fixed and very difficult of access for purposes of palpation and inspection, that my direct duodenoscopy and diaphanoscopy are of great importance as regards the diagnosis.

This method is of even greater importance, perhaps, in cases of profuse, perilous hemorrhages from small ulcerations of the mucous membrane (*exulceratio mucosæ simplex*) which have been thoroughly described by Dieulafoi. These cases are, indeed, relatively rare, but they involve on the other hand an enormous danger to life, in face of which surgeons have hitherto stood helpless. This is a consequence of the fact that such ulcers are so small that, even on the dissecting table, one may not succeed in showing the little ulcer which has occasioned the fatal hemorrhage. One can understand, therefore, how much more hopeless it is to search on the operating table for such a tiny ulcer, and all the more so because the question concerns patients who are already in a state of collapse and extremely weak from excessive loss of blood.

But neither with these hemorrhages need we any longer remain helpless, since we have had the direct diaphanogastros-copy. Even in my first report on this method of examination, I predicted that it would probably bring about a revolution in the treatment of perilous hemorrhages from small ulcerations of the mucous membrane, because the demonstrating of such by illuminating the stomach would now be an easy and safe task. The bleeding spot would betray its presence as a dark point, interrupting the course of an artery, and from this a dark stripe down toward the great curvature would indicate the current of the blood. Such I have seen with an accidentally arisen hemorrhage. I imagined that one *might stop the bleeding surrounding the bleeding point with a purse-string suture*

direct from the outside during the illumination, an operation very easy to perform in a few moments.

My prediction was verified more rapidly than I had dared to hope, because only a few days after I had read my original paper before the medical society a woman suffering from an acute, profuse hemorrhage from the stomach was admitted to the ward of the senior physician, Dr. Vermehren, at Frederiksberg Hospital; and as the hemorrhage could not be stopped by severe internal treatment, and as the condition of the patient was becoming perilous, Dr. Vermehren transferred the patient to the head surgeon, Dr. Kraft, who then immediately operated on the patient. As soon as the gastroscope was introduced and the stomach illuminated, Dr. Kraft noticed a dark spot on the anterior wall of the stomach, and an artery running straight up to this spot, when it was interrupted abruptly. Through the gastroscope he verified the result of the diaphanoscopy, and demonstrated a small exulceration of the mucous membrane exactly on this spot. He then slit the stomach wall from the gastroscopy wound up to this ulcer, and inserted the ligature from the inside, after which the incision was closed. The patient recovered. Beside this case, five similar operations have resulted successfully by the co-operation of these two eminent physicians. On each occasion Dr. Kraft has succeeded, by means of gastrodiaphanoscopy, in quickly and surely demonstrating the small bleeding ulcer, and in these five cases he employed the far quicker and more simple mode of procedure which I have just mentioned, to make straight for the bleeding spot during the illumination, and surround it from the outside with a silk thread going through all the layers. On the outside of this a serosa suture was made for safety's sake. Only one of these patients died, but this was due to a sad accident during the gastroscopy, by reason of a failure in the town current supplied to the electric apparatus employed, which led to an extensive burn of the stomach—an accident which can never occur if one employs an accumulator as a source of light, which one naturally ought always to do after this experience. If this accident had not occurred, Dr. Kraft

would probably have the unique result of a percentage of 100 recoveries with this series of extremely serious cases. But even the five recoveries speak highly in favor of the method.

I therefore venture to assert that we have obtained in the direct gastroduodenoscopy described a method which, in those difficult cases where all other diagnostic expedients are insufficient, enables us to give the exact diagnosis in cases of disease in the stomach and the duodenum. It is of special importance in three directions:

1. In the numerous cases where the symptoms speak in favor of ulcer, but where inspection and palpation of the stomach show nothing of the sort. Here gastroduodenoscopy removes all doubt, and sometimes shows us that the supposed ulcer does not exist, whereby the patient is spared a senseless and injurious encroachment; and sometimes it proves the presence of the ulcer, its seat, and its nature.

2. For the differential diagnosis between ulcers in the stomach and the duodenum.

3. By rendering possible a direct attack upon the ulcer, where one had formerly to content oneself with gastro-enterostomy because the seat of the ulcer was unknown. This is of exceptional importance with ulcers, the hemorrhages from which constitute a menace to life, whether they be permanently oozing, small bleedings, or violent, acute hemorrhages. Nor, naturally, is this method infallible; as with it also one may sometimes overlook a small ulcer which has concealed itself in the folds of the mucous membrane, and may sometimes interpret a depression as being the edge of an ulcer or something similar, but this is of rare occurrence.

I do not hesitate, therefore, to introduce and recommend this method to American surgeons, confident that in their hands it will be bettered and will produce even better results than it has done in mine.

THE CONSERVATIVE TREATMENT OF GIANT-CELL SARCOMA, WITH THE STUDY OF BONE TRANSPLANTATION.*

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THE ultimate results of the cases of periosteal and medullary giant-cell sarcoma which I have observed personally, and similar records from the literature which I have been able to collect up to the present writing, confirm the conclusion reached many years ago—that conservative treatment is justifiable for this disease.

It seems to me that our accumulated experience is sufficient to-day to allow any surgeon who can make the diagnosis to follow conservative lines. It should not require courage—the procedure is no longer experimental. Nevertheless, correspondence with my colleagues in this country forces the statement that many surgeons hesitate to treat giant-cell sarcoma of bone by any method except amputation. Others prefer a wide resection to curetting.

I became interested in sarcoma of bone when I first came to Baltimore in 1892, and I remember distinctly that Dr. Halsted frequently referred to Koenig's case or two of giant-cell sarcoma which were curetted with good results. Along with other problems in surgical pathology, I began to investigate critically all the material of bone sarcoma in the Johns Hopkins Hospital.

From correspondence with the patients it at once became evident that there was something different in the so-called giant-cell sarcoma. Practically all of these patients answered the letters. Most of the other cases of bone sarcoma had died of the disease.

In 1899, when I first began to write critical reviews for

* Read before the American Surgical Association, May 30, 1912.

Progressive Medicine, I discussed in the first number (December, 1899, p. 238) the question of resection instead of amputation for malignant sarcoma of the long bones. I could not find the reference to Koenig.¹ Mikulicz (*Archiv. f. klin. Chir.*, 1895, Bd. 1, p. 661) apparently was one of the first to practise and publish on this subject. Wiesinger followed with a short report (*Deutsche med. Wochenschr.*, Oct. 20, 1898). Then there were reports of conservative treatment by Morton (*British Med. Jour.*, July 23, 1898), Karewski (*Berliner klin. Wochenschr.*, Aug. 22, 1898) and Hinds (*British Med. Jour.*, February 26, 1898). Since this date (1899), now a period of almost thirteen years, I have carefully reviewed practically all the important contributions to the literature in the December numbers of *Progressive Medicine*, at the same time recording my own accumulating experience.

In April, 1901, I was given the opportunity in a meeting of the Philadelphia Academy of Surgery to discuss a very scholarly address by John A. Wyeth, of New York (*ANNALS OF SURGERY*, 1901, xxxiv, 594), on amputation at the hip-joint for sarcoma and the tendency to recurrence. Apparently I was the only one who took the view that conservative treatment was justifiable, even in the giant-cell sarcoma. I gave reference there to the literature, calling attention, first, to Koenig's statement in his text-book many years ago; to the cases which I had studied in Dr. Halsted's clinic from 1889 to 1901, a period, then, of twelve years. I got the impression that I told the truth to the wrong audience.

In December, 1902, I was given the opportunity to test the strength of my own convictions. A patient, aged twenty-nine, came under my care with a medullary tumor in the upper end of the tibia. I had seen a few X-rays of giant-cell sarcoma at that time. These pictures I reproduce here again (Fig. 1, anteroposterior view, and Fig. 2, lateral view). I

¹ The early literature on the conservative treatment of sarcoma of the long bones will be found collected and reviewed by Von Haberer, *Zeitschr. f. Heilkunde*, 1906, vol. new series vii, Heft 1, who also reports the experience of Von Eiselsberg's Clinic in Vienna.

was not certain of the diagnosis before operation, but from the long history of symptoms—at least nine years—and the demonstration of the preservation of a distinct bone capsule in the X-ray, I concluded that the medullary tumor was probably a giant-cell sarcoma. This case was reported in detail in 1903 (*Johns Hopkins Hospital Bull.*, vol. xiv, p. 138, May, 1903) and has been referred to frequently since that date in the December numbers of *Progressive Medicine*.

At that time I told the patient that in the cases which I had studied in the Surgical Pathological Laboratory and among those mentioned in the literature, I had been unable to demonstrate a single authentic death from a pure medullary or periosteal giant-cell sarcoma. I told him that cases had been cured by curetting, that a number of cases curetted had recurred, and been subsequently cured by a second curetting; others by a later resection in continuity, and still others by a later amputation; but that as far as I could ascertain by a most diligent search, no harm had been done by an unsuccessful curetting. In his case a successful curetting would mean a cure with a limb practically unimpaired as to function, while resection would result in much shortening. At that time our technic of bone transplantation had not been developed.

This patient chose curetting. The tumor was easily recognized at the exploratory incision; the curetting was performed with an Esmarch on the thigh; after curetting, the cavity was thoroughly disinfected with carbolic acid, and the wound packed tightly with gauze. The wound was long in healing. To-day we would have transplanted into the cavity a piece of bone to hasten healing. This patient is well (July, 1912), with a serviceable limb almost ten years since operation.

In my paper before this Association in 1910 (*Transactions of the American Surgical Association*, 1910, p. 39, and *ANNALS OF SURGERY*, August, 1910, vol. lii, p. 145), I reported the cases of giant-cell sarcoma which had remained well after curetting. I will add to that list in this, the second, communication.

The points I wish to emphasize first, therefore, are, that

the statement made to this patient in 1902 holds equally good to-day; that it can be supported by more evidence, and that each case is stronger from the fact that the period of freedom from recurrence since the operation has increased.

TRAUMA AND BONE SARCOMA.

Many investigators, both clinical and experimental, have been interested the last few years in the possibility of a precancerous lesion. By this is meant a visible, palpable lesion of a benign nature, either a benign tumor or an inflammatory focus. In this benign lesion, experience teaches, there is a possibility of malignant degeneration. Apparently all agree that cancer usually begins in such a lesion and rarely, if ever, in the normal epidermis or mucous membrane. In most instances the benign lesion is recognizable and always easily removable. Why not, therefore, be on the lookout for such lesions? If these were removed, might we not expect a great decrease in the number of cancers of the skin and mucous membrane?

In investigating sarcoma of bone, it is much more difficult to demonstrate a precancerous lesion than in cancer of the skin and mucous membrane, but one fact stands out prominently, and that is—trauma.

I have been impressed in this investigation with the great importance of looking upon contusions of bones and joints with a more critical eye than has been done in the past, and I have come to the conclusion that an X-ray examination after the injury, and later at intervals if the symptoms do not disappear, is the only means by which we can recognize the more malignant types of bone sarcoma at an earlier period.

In 1910 there were 154 examples of bone lesions in the Surgical Pathological Laboratory of the Johns Hopkins Hospital (Recent Progress in the Surgical Treatment of Malignant Growths, *Jour. of Amer. Med. Assoc.*, Oct. 29, 1910, vol. lv, p. 1527).

Among these 60 were distinctly benign tumors. Of these again 34 may be looked upon as exostoses, 20 benign bone

cysts or osteitis fibrosa, and 6 rare benign tumors: myxoma, chondroma, osteoma, and fibroma. There is apparently little relation between the trauma and the periosteal exostoses—most of these seem to be of congenital origin and are often multiple. A single or a repeated trauma may excite the growth in one of the tumors. The X-ray makes the diagnosis. The relation of trauma to the benign bone cyst and osteitis fibrosa is much more manifest. I am inclined to the view that the number of benign bone cysts shows increase in recent years due to the systematic X-ray studies after all injuries when there are clinical signs of fracture. Recent experience has shown that bone cysts may heal spontaneously, and undoubtedly in the past many cases present in the bones at the time of the fracture have healed and were overlooked, because no X-ray was taken.

In this group of benign bone lesions an earlier X-ray study would reveal the lesion when it is smaller, and thus allow treatment at a period in which a cure could be accomplished with less mutilation and a shorter period of disability.

The number of giant-cell sarcomas in my collection in 1910 was 22: three periosteal and 19 medullary. Since then I have observed four further cases of the medullary type. It is the medullary giant-cell sarcoma that I am considering in this paper. The clinical records of these 26 cases show that if a routine examination had been made with the X-ray in cases where the pain did not disappear quickly after a slight contusion, or when, without the history of a trauma, such an X-ray study had been made because of pain or limp, the disease would have been recognized at a much earlier period. Now, as a matter of fact, all of these 26 cases are living, and the same is true of the cases collected from the literature, but in many instances, perhaps the majority of cases, the tumor had reached a size which necessitated a much more radical operation than curetting. The earlier X-ray studies, therefore, will not increase the number of cures in giant-cell sarcoma, but will undoubtedly increase the number of cases in which the diseases can be removed without mutilation.

The remaining cases in my table are malignant. There are eight cases of the less malignant type, 50 of the most malignant forms of sarcoma, one multiple myeloma, and 13 cases of metastatic carcinoma. Among the 50 examples of sarcoma of the most malignant type, in 18 the disease was inoperable; in 34 high amputation was performed without a single cure. Among the eight examples of less malignant sarcoma there were five permanent cures—three periosteal osteosarcomas, two out of four myxochondrosarcomas, and one fibrosarcoma.

The only hope of increasing the number of cures among the less malignant sarcomas and of accomplishing a single cure among the most malignant sarcomas depends upon the diagnostic employment of the X-rays after simple injuries when the symptoms do not subside rapidly and for cases complaining of localized pain in a bone or joint. My investigation teaches me that the employment of the X-rays as an aid in the early diagnosis of lesions of bones and joints cannot be urged too strongly.

Pathol. No. 12379. Joint Fracture of Articular Surface of Tibia.

Fig. 3 is the X-ray of a knee-joint after a slight contusion. It shows a fracture of the articular surface of the tibia. The separated piece of bone was easily replaced through an arthrotomy about six days after the injury, and the patient was able to work after four weeks. There could be no dispute as to the different result if this X-ray had been omitted and the sprained knee treated by ordinary methods.

X-rays of the early stage of the more malignant periosteal and medullary sarcomas of bone are conspicuous by their absence in the literature, and I have only one in my personal collection.

Pathol. No. 12050. Early Picture of Periosteal Spindle- and Round-cell Sarcoma.

Fig. 5 shows an anteroposterior view of the knee-joint. The outer condyle of the femur is abnormal; there is slight erosion of

bone, breaking the line of the outer table, and some new bone formation. I have compared this with traumatic ossifying periostitis, luetic periostitis, the bone changes in the different types of arthritis, and this investigation has clearly illustrated that the shadow in this case was sufficiently different to arouse the suspicion that it was the beginning of a periosteal sarcoma and to justify exploration. Fig. 6, the lateral view, shows toward the popliteal space a fairly large defect in the outer condyle. These X-rays were taken in June, 1911, because the patient had pain in the knee with limp, but no swelling. He refused operation at that time. I did not see the patient until September 29, three months later. In this time a huge tumor had formed in the popliteal space, had ulcerated, and become infected. Amputation was performed, but the patient died of infection and the autopsy revealed metastasis. Here, therefore, was the opportunity for an earlier intervention, but for some reason the method of presenting the operation to the patient was not successful.

Pathol. No. 12845. Infectious Arthritis of Left Acromioclavicular Joint.

The patient, a male aged forty-nine, suffered in February, 1912, from a purulent rhinitis; about the tenth day of this infection pain in the left shoulder was experienced and was most marked on forced motion; there was pain in no other joints. The discharge from the nose disappeared, but the localized pain persisted; swelling was observed three weeks ago, about three months after the onset of pain. He has received local and general treatment for rheumatism, but no effort has been made for exact diagnosis. At my examination, May 25, I found a little soft swelling over the joint, suggesting thickening of the capsule and some fluid; local tenderness and pain on forced motion. The X-ray (Fig. 4) shows light bone destruction and some bone formation. It suggests more osteoarthritis than periosteal sarcoma. The Wassermann reaction was negative, also the tuberculin test. I advised exploration, because it was my opinion that periosteal sarcoma in its earliest stages could not be excluded. If this disease were present the chances for a cure were best now; in addition, the exploration would probably hasten the cure of an inflammatory process. The operation was performed May 27, 1912, under novocaine: the capsule of the joint was thickened, the joint contained clear fluid; there was some bone destruction

and a little periosteal bone formation; some of this tissue was removed, the wound disinfected with carbolic acid and alcohol, and closed. The frozen sections show an inflammatory process. The wound healed *per primam*, and on July 15 the local pain and tenderness had disappeared.

In a second paper I propose to publish with illustrations a discussion of the differential diagnosis of the different types of periostitis, osteomyelitis, arthritis, and ossifying myositis from sarcoma. At the present time, however, I have a large collection of only the benign and inflammatory lesions, and only this one of sarcoma in its early stage.

THE TREATMENT OF SARCOMA OF BONE WITH COLEY'S SERUM.

It is my opinion that we owe Dr. Wm. B. Coley, of New York, a debt of gratitude for his persistent efforts to treat sarcoma with the toxins of streptococcus and *Bacillus prodigiosus*. I agree with him that this serum should be employed in all inoperable cases; that it also should be used before and after operation in operable cases when the sarcoma is of a type which experience has shown to be very malignant, and in which few, if any, cures have been accomplished.

I cannot agree with Dr. Coley, however, in his advocacy of this treatment for giant-cell sarcoma, and I do not think he is justified in including cases of giant-cell sarcoma among his cured cases as additional evidence of the efficacy of his serum.

I have now 26 cases of giant-cell sarcoma which I have studied personally. Every one of these patients is well. In not a single case was there any treatment other than removal of the disease by the curette, by excision, or by amputation. The same is true of a large number of cases recorded in the literature. It seems to me that there is no more reason for giving a patient with giant-cell sarcoma, Coley's serum, X-ray, or radium treatment, than to employ them for lipoma, exostosis, or any other type of benign tumor. I cannot find in Dr. Coley's reports any evidence to justify the conclusion that the treatment of the patient with toxins before and after

operation will allow the surgeon to perform a less radical operation when the disease is too extensive for curetting. If Dr. Coley could furnish this evidence, it would at once justify its employment in late cases.

I have a letter from Dr. Coley dated March 6, 1912, concerning a case which I shall report in this paper. The tumor involved the lower end of the ulna (Figs. 27, 28, and 29). Dr. Coley agreed with me that local resection was justifiable, but he earnestly recommended the employment of toxins before and after operation.

The objection to the toxins in medullary giant-cell sarcomas is the discomfort which follows each injection, and, in my opinion, the lack as stated before of any evidence that it is necessary.

MEDULLARY GIANT-CELL SARCOMAS WHICH HAVE REMAINED WELL
AFTER ONE CURETTING.

CASE I (Pathol. No. 4520, Figs. 1 and 2, Bloodgood).—Curetting Dec. 4, 1902. Well May, 1912, nine years and five months. Large tumor in upper end of tibia. Symptoms nine years. In this case amputation had been advised.

CASE II (Pathol. No. 6893, G. G. Davis, of Philadelphia).—Operation December, 1904. May, 1912, well, seven years and five months. Tumor lower end of ulna.

These two cases were previously reported in the *Transactions of the American Surgical Association* for 1910 and the *ANNALS OF SURGERY* for August, 1910.

Since this report two further cases have come under my observation:

CASE III (Pathol. No. 12926, operator Dr. John W. Chambers, of Baltimore).—Medullary giant-cell sarcoma of upper end of right fibula. The patient is a white female aged twenty-three; 17 months before operation she received an injury in this area while roller-skating. The pain has never entirely disappeared; swelling was observed six months after the injury and gradually increased; pain was experienced chiefly when walking. On examination there was a uniform expansion of the upper end of the

fibula; no fluctuation; the skin was tense over the swelling, and the superficial veins prominent. The X-ray (Figs. 7 and 8) suggests giant-cell sarcoma because of the very thin bone capsule. On May 11, 1911, Dr. Chambers first divided the fibula below the tumor preparatory to resection; then, after exploration of the tumor, decided to curette, which was done. The bone cavity was then disinfected with carbolic acid, followed by alcohol and packed with gauze. I have examined the sections from the tumor and agree with Dr. Chambers's diagnosis of giant-cell sarcoma. Fig. 9, an X-ray ten months after operation, shows the healed fracture of the fibula below the tumor and the bone cavity partly filled with new bone. This patient is apparently well one year after operation.

In this case the bone capsule was very thin, and if this patient remains free from recurrence, we will have an extreme test of curetting. In view of my own experience and that in the literature, and in view of the fact that resection of this portion of the fibula does not interfere with function of the limb, I should have resected in a case of this character.

CASE IV (Pathol. No. 12207, operator Dr. A. R. Kimpton, of Boston).—The patient is a child five years of age. One year and four months before operation the child fell from a porch only about 12 inches high, striking on soft earth; in spite of this slight injury a fracture of the shaft of the tibia resulted; no X-rays were taken then. Following this there was more swelling than was to be expected after a simple fracture, and this continued without pain; it was tender, however. The X-ray (Fig. 10) was taken just before operation. It is unusual for either a cyst or a giant-cell tumor to be localized so far from the epiphysis. At the operation in November, 1911, Dr. Kimpton writes, he found the tumor had perforated the thin periosteum at one point. The tumor was soft, light yellow in color, with radiating bands of fibrous tissue; there were no cysts. The growth was removed by curetting, and some of the surrounding bone was chiselled; the cavity was disinfected with Harrington's solution. On account of bleeding the cavity had to be tightly packed with gauze. This gauze was removed on the fifth day and the wound closed. Figs. 11 and 12 show the result four months after operation: there is no appear-

ance of recurrence. The child is apparently well June, 1912, seven months since operation. Drs. Mallory and Nichols report on microscopical examination a giant-cell tumor with considerable fibrous tissue.

On further study this case may prove a border-line pathological condition between a bone cyst, osteitis fibrosa, and a giant-cell tumor. I am now investigating this question and trust to make a report later.

The following cases have been collected from the literature. They are all medullary giant-cell sarcomas which have remained well since curetting, and were all included in my previous publication.

O. KOCHER: Left tibia; patient well three years. Patient aged twenty-six; symptoms two years and three months.

KRAMER: Lower end of femur; patient well twelve years. Age sixteen, symptoms six months.

KRAMER: Upper end of humerus; patient well eight years. Age thirteen years, symptoms six months.

KAREWSKI: Inner head of tibia. Patient aged twenty-six, tumor six months. Well eighteen months (*Progressive Medicine*, Dec., 1899, plate iv, p. 242).

KAREWSKI: Shaft of femur; patient well four years. Age of patient and duration of tumor not stated.

HINDS: Lower third of femur; patient well sixteen years. Age thirty-four, symptoms fifteen months (see Fig. 33).

These five cases are reported as giant-cell sarcomas of the medullary type.

JENCKEL: Here the tumor was situated in the trochanter minor of the femur. The patient was twenty-two years of age, and the symptoms had been present four and one-half months. The tumor is described as having a distinct bony shell and bloody contents. There is no microscopic description of the wall. The gross description corresponds to that recorded by G. G. Davis in his case in which the tumor was situated in the lower end of the ulna. This patient of Jenckel remained well twelve and one-half years after curetting. The diagnosis rests between a giant-cell sarcoma and a bone cyst.

There are, therefore, at the present time, nine examples of medullary giant-cell sarcoma which have not recurred after curetting.

I have examined the tissues in four of these cases, and

FIG. 1.



Pathol. No. 4320. Bloodgood's case. Medullary giant-cell sarcoma of upper end of tibia. Age 49, symptoms 9 years. Well nine years after curetting. X-ray before operation, anteroposterior view.

FIG. 2.



Pathol. No. 4320. Same as Fig. 1. Lateral view.

FIG. 3.



Pathol. No. 12470. Bloodgood's case. St. Agnes Hospital. Fracture of articular surface of tibia. X-ray three days after injury (joint fracture). This bone was replaced by arthroplasty. Perfect result.

FIG. 4.

Path. No. 12845



Pathol. No. 12845. Male, aged 49; pain acromioclavicular joint three and one-half months; swelling 2 months. X-ray shows bone destruction and bone formation at this joint. Diagnosis of joint inflammation confirmed at exploratory incision.

FIG. 5.



Path. No. 12050

Pathol. No. 12050. X-ray taken by Dr. Cotton of Mercy Hospital. Anteroposterior view. Early picture of a perosteal spindle and round-cell sarcoma of the outer condyle of the femur. At this time the patient complained of pain only. There was a slight limp, but no swelling.

FIG. 6.



Path. No. 12050

Pathol. No. 12050. Lateral view of X-ray shown in Fig. 5.

FIG. 7.



Chambers's case. Medullary giant-cell sarcoma of upper end of fibula. X-ray before operation taken by Dr. Cotton. Anteroposterior view. Note the large size of the tumor, with preservation of the bone capsule. Female, age 23. Trauma 17 months, pain and swelling 11 months.

FIG. 8.



Same case as Fig. 7. Lateral view before operation.

FIG. 9.



Chambers

Chambers's case. X-ray 10 months after operation—curetting. Note the new bone formation filling the cavity occupied by the giant-cell sarcoma which was removed by the curette. This new bone comes from the bone capsule. The fibula below was fractured at the operation. Well, 13 months.

FIG. 10.



P.N. 12207

Pathol. No. 12207. Kimpton's case. Medullary giant-cell sarcoma of shaft of tibia in a baby. X-ray, lateral view before operation.

FIGS. 11 AND 12.

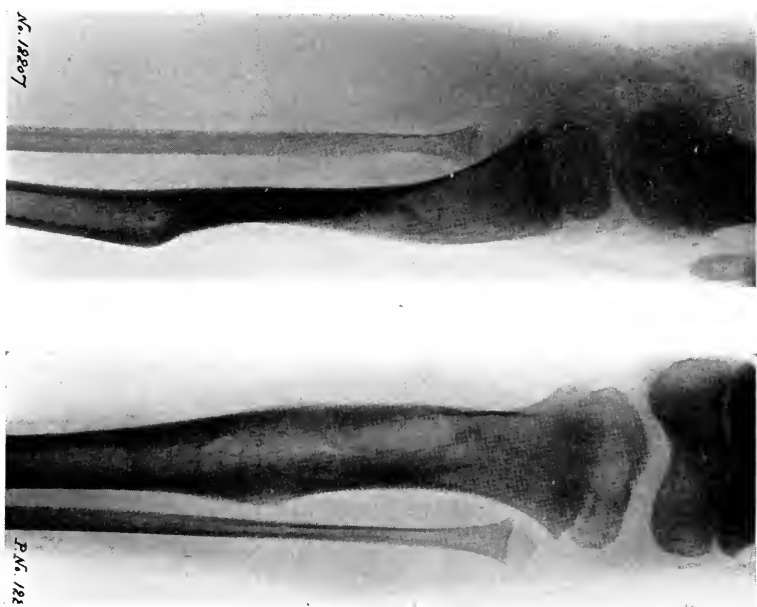


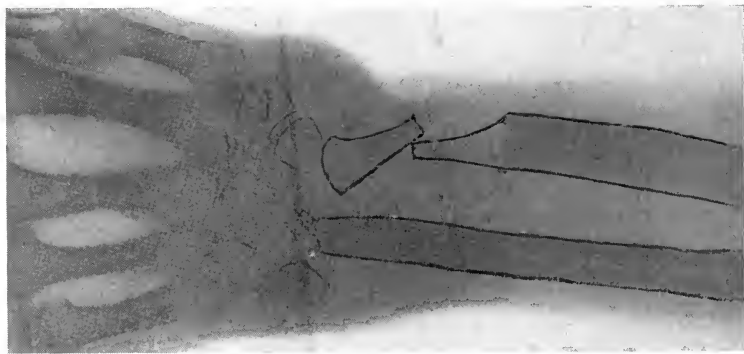
FIG. 13.



Pathol. No. 12207. Kimpton's case. X-rays four months after operation. Anteroposterior and lateral views. See Fig. 10 for X-ray before operation. X-rays taken by Drs. Dodd and George, of Boston.

Pathol. No. 10376. Chambers's case. The result many months after the second curetting of a giant-cell sarcoma shown in Fig. 34 of my previous communication.

FIG. 14.



Pathol. No. 8412. Bloodgood's case. X-ray after operation. To illustrate transplantation of piece of ulna into radial defect. X-ray retouched, as it was too faint for reproduction.

FIG. 15.



Pathol. No. 275. Dr. Halsted's case. Periosteal giant-cell sarcoma of lower end of ulna. Age 45, tumor one year. Resection of lower end of both bones with tumor. Photograph of result. No recurrence 15 years after operation.

FIG. 16.



Pathol. No. 6125. Dr. Halsted's case. X-ray before operation. Patient aged 22, tumor 20 months. Resection of lower end of both bones. Well seven years, function of hand impaired. X-ray by Dr. Baetjer.

FIG. 17.



Pathol. No. 10975. Bloodgood's case. Photograph of patient, age 20; pain three years, swelling one year.

FIG. 18.



Pathol. No. 10975. Bloodgood's case. X-ray by Dr. Ashbury before operation.

FIG. 19.



Pathol. No. 10975. Photograph of a section through the tumor shown in Figs. 17 and 18. Note that the disease has extended to the joint capsule, and the bone shell is very thin and absent in some places.

FIG. 20.

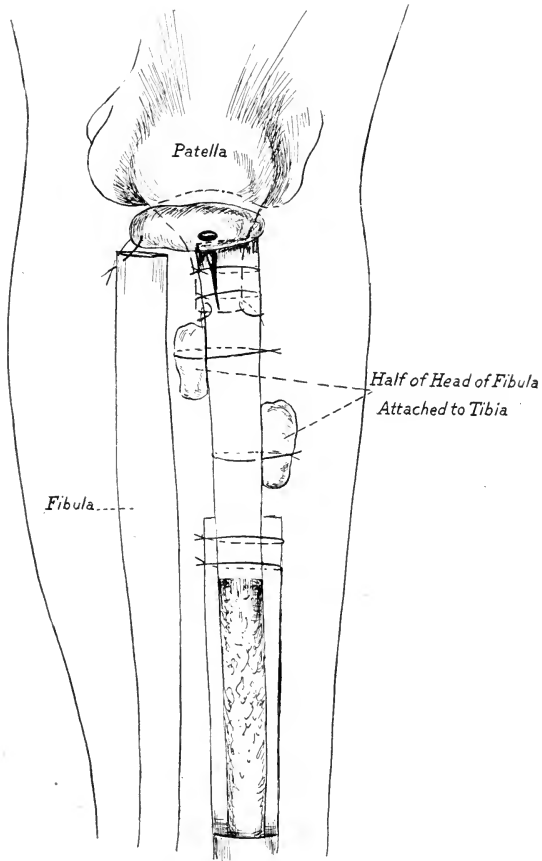


Diagram showing transplanted bones fixed in position with wire and screws.

FIG. 21.
a

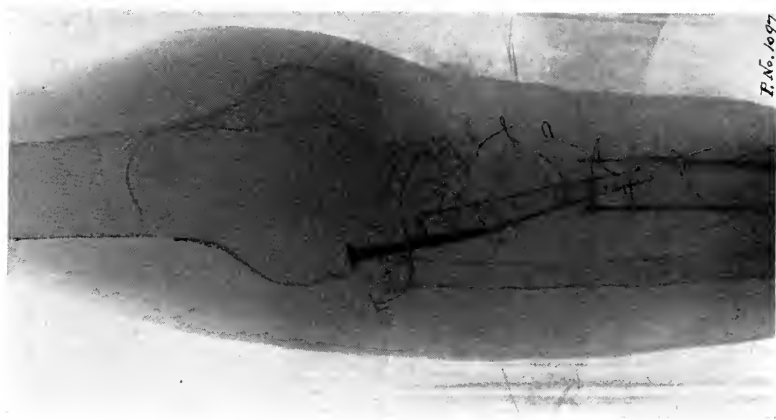
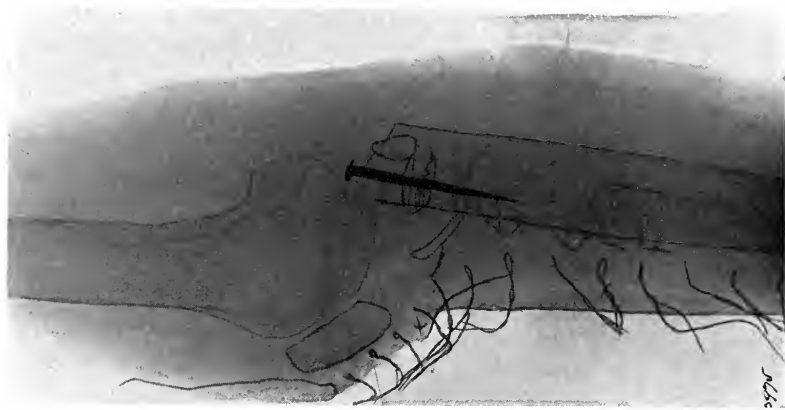


FIG. 21.
b



Same as Fig. 21 *a*. Lateral view.

Pathol. No. 10975. Bloodgood's case. X-ray one month after transplantation of bone.

FIG. 22.
a



FIG. 22.
b



Same as Fig. 21. X-RAYS, eighteen months after operation. *a*, lateral view; *b*, anteroposterior view.

FIG. 23.



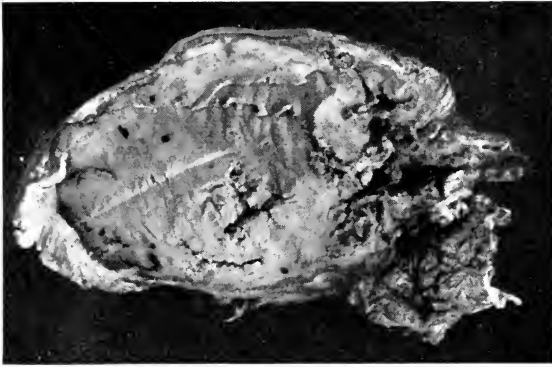
Pathol. No. 10975. Bloodgood's case. Photograph of the limb six weeks after operation (see Figs. 21 and 22). The limb one year and six months after operation has the same appearance.

FIG. 24.



Pathol. No. 11855. Bloodgood's case. Medullary giant-cell sarcoma of upper end of fibula. X-ray before operation by Dr. Baetjer. White female, aged 21, trauma seven months; pain, swelling five months. Resection. Nine months well.

FIG. 25.



Pathol. No. 11855. Photograph of specimen excised. See Fig. 24 for X-ray.

FIG. 26.



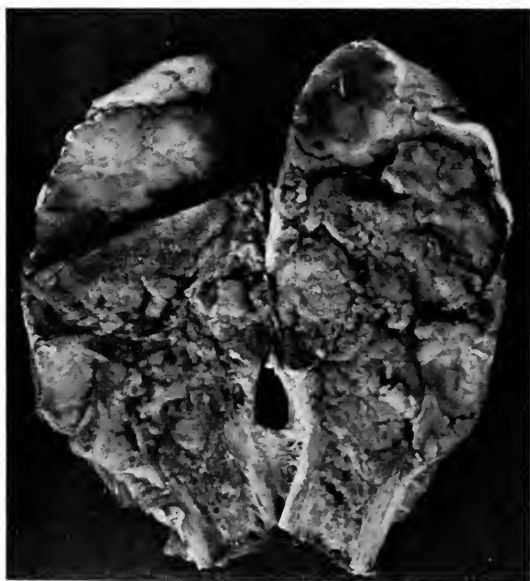
Pathol. No. 11855. Bloodgood's case. X-ray after operation of case shown in Fig. 25. There is absolutely no weakness in this leg, in spite of the defect in the upper third of the fibula. Compare with Chambers's case, Fig. 9.

FIG. 27.



Pathol. No. 12474. Bloodgood's case. Medullary giant-cell sarcoma lower end of ulna. Patient aged 48; trauma 8 months; pain since; swelling 2 weeks. Resection, bone transplantation. X-ray before operation.

FIG. 28.



Pathol. No. 12474. Photograph of the bisected tumor (by Mr. Schapiro), removed in case shown in Fig. 27. Note the thinness of the capsule, the red currant-jelly areas and the white areas. Giant-cells predominate in the red areas, osteitis fibrosa in the white areas.

Fig. 29.



Pathol. No. 12474. X-ray after operation in case shown in Figs. 27 and 28. Illustrates the transplanted piece of tibia. The patient has good function.

Fig. 30.



Pathol. No. 12927. Patient of Dr. Emil G. Beck. Giant-cell sarcoma of lower end of radius. Resection.

FIG. 31.



Pathol. No. 10929. Bloodgood's case. Benign bone cyst, recurrent twice after curetting. Third extensive curetting with transplantation of piece of tibia to fill the defect. This X-ray was taken after operation.

FIG. 32.



Same case as Fig. 31. X-ray of tibia six weeks after a piece had been excised for transplantation into the cavity of the humerus.

FIG. 33.



X-ray of the result of curetting of a giant-cell sarcoma involving the lower end of the femur more than eighteen years after operation. Taken July, 1912. Case of Dr. Frank Hinds, of England. First reported in the British Med. Jour., February 26, 1898. See page 220.



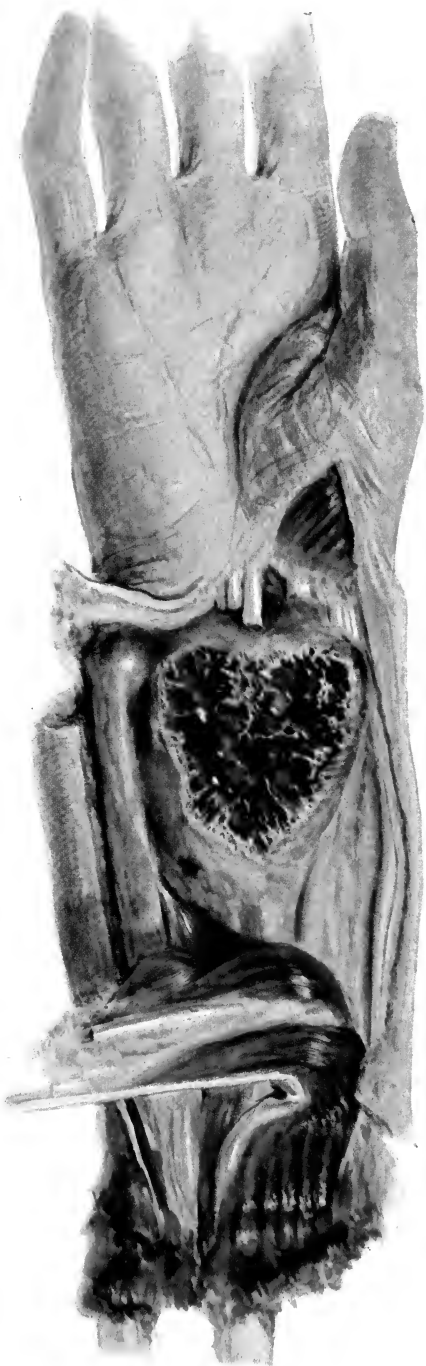


FIG. 34.

Pathol. No. 1815. Giant-cell sarcoma of lower end of radius. Dr. Halsted's case. White male, aged 45. Fracture (Colles') 2 years 4 months; apparent recovery. Three months later pain and swelling. Amputation of arm. Twelve years well (1912). X-ray and painting of specimen show that the tumor is distinctly within a bone capsule and could have been cured by curetting or excision. (Painting by Dr. Harvey Cushing.)



operated on one. In the five cases taken from the literature the pathological reports are sufficiently clear to allow a diagnosis of a giant-cell sarcoma. None of these cases received either the X-ray or the serum. In all of them, as far as I can ascertain, the cavity was disinfected with pure carbolic acid, followed by alcohol, as in my case, or by some other disinfectant, in addition to curetting. I have emphasized this point in technic in my previous communication. Prof. von Eiselsberg, in the discussion two years ago, also emphasized the importance of disinfecting the cavity after curetting.

MEDULLARY GIANT-CELL SARCOMAS WHICH HAVE RECURRED AFTER
THE FIRST CURETTING, BUT HAVE REMAINED WELL
AFTER THE SECOND.

CASE I (Pathol. No. 10376).—The tumor was situated in the lower end of the radius in a female aged twenty-five, with symptoms five months after trauma. The disease was curetted in April, 1908, by Dr. Chambers, of Baltimore; there was a recurrence with a second curetting a few months later. I am informed to-day (July 17, 1912) by Dr. Chambers that the patient is well and has a most useful arm. I have also just seen the recent X-rays of the result. This case has been previously reported. Fig. 13 shows the lower end of the radius after curetting. This X-ray of Chambers's case before operation should be compared with that of Beck (Fig. 30). The latter felt that resection was indicated.

MEDULLARY GIANT-CELL SARCOMAS WHICH RECURRED AFTER CURETTING, BUT HAVE REMAINED FREE FROM RECURRENCE
AFTER A LOCAL RESECTION.

CASE I.—This case has been previously reported by me (Pathol. No. 9881). Operation March, 1909, by Dr. J. C. DaCosta, of Philadelphia: curetting of a tumor entirely confined to the inner condyle of the lower end of the femur. There was a recurrence, and in July, 1909, four months later, I was given the opportunity by Dr. DaCosta to resect the condyle. This patient is well (May, 1912) now almost three years. The illustrations will be found in my previous report in the ANNALS OF SURGERY, Figs. 32 and 33.

CASE II (Pathol. No. 8412).—This case has also been pre-

viously reported. (Fig. 35 in the ANNALS OF SURGERY.) The patient was twenty-nine years of age and had had a swelling of the lower end of the radius twenty months. The swelling had followed a trauma. There had been three operations before I saw the patient, four, twelve, and sixteen months ago. The first two were curettings, the third a resection of the lower end of the radius. In August, 1907, I resected the encapsulated recurrent tumor occupying the position of the lower end of the radius and transplanted the ulna into the defect (Fig. 14). This patient has remained well nearly five years since operation and has very good function.

Jens Schou (*Centralbl. f. Chir.*, 1911, xxxviii, 230) reports briefly what may have been a giant-cell sarcoma of the lower end of the ulna. His first attempt was curetting and X-ray treatment, but without result; he then resected the lower end of the ulna with the tumor and reports, almost three years after operation, no recurrence, good motion, and no deviation toward the ulnar side. If this is correct, it would apparently suggest that it is unnecessary to transplant bone into an ulnar defect after resection, as done by me in a case to be reported in this paper.

MEDULLARY GIANT-CELL SARCOMAS WHICH HAVE RECURRED AFTER
CURETTING AND HAVE REMAINED WELL AFTER AMPUTATION.

CASE I.—Previously reported (see Fig. 31 in ANNALS OF SURGERY) (Pathol. No. 7440). Operation January 26, 1906, by William J. Taylor, of Philadelphia. There was a recurrence in a few months followed by amputation. The patient is well (May, 1912) more than six years since the amputation.

In two additional cases there was curetting for diagnostic purposes followed by amputation. In one of them (Pathol. No. 1815, Fig. 34), with the tumor in the lower end of the radius, the patient is well sixteen years after an amputation by Dr. Halsted at the Johns Hopkins Hospital. The second case was under the care of Dr. Jas. F. Mitchell, of Washington. The curetting for diagnostic purposes was performed by Dr.

J. B. Murphy, of Chicago, the amputation later by Dr. Mitchell. This patient is well four and one-half years after operation. I have seen the microscopic sections from this case (Pathol. No. 7861; see Fig. 38 of the previous report).

The evidence, therefore, demonstrates that no harm can come from an attempt to cure by the removal of the tumor with the curette. The technic of this has been described in my previous communication. The operation should be performed under an Esmarch, the wound disinfected after the curetting, and the cavity packed tightly with gauze before removing the Esmarch. There is always danger of hemorrhage. I have experienced this in curetting the large tumor from the upper end of the tibia. Taylor had the same experience in the lower end of the femur. Davis had no trouble with his small tumor at the lower end of the ulna of a child, nor had Kimpton with his tumor in the shaft of the tibia. The probability of severe hemorrhage undoubtedly depends upon the size and situation of the tumor.

My recent experience teaches me that we can hasten the healing of the cavity after curetting by transplanting into the cavity a piece of bone. I would recommend this, if the hemorrhage can be checked and the cavity is large enough to require it. I am inclined to the view that in Emil Beck's (Fig. 30) case it would have been possible to avoid resection by employing this method.

The new point, therefore, which I am presenting here, is that bone transplantation will in the future probably allow us to more frequently employ the curette in the treatment of a giant-cell sarcoma, and in some cases, where the bone shell is very thin, it will allow us to restore the continuity of the bone by a less difficult procedure than resection and bone transplantation. I am quite certain that in my case of giant-cell sarcoma of the upper end of the tibia, I could have removed the gauze after the tenth day and transplanted a piece of the opposite tibia into the defect. I have done this recently in a cavity of a large bone cyst with a perfect result (Figs. 31 and 32). In Davis's case of tumor of the lower end of the ulna

and in Chambers's case of the lower end of the radius, the cavity was not large enough to make transplantation necessary. It is quite possible that Dr. Chambers subconsciously restricted the extent of his first curetting, fearing injury to the continuity of the bone. But, with the knowledge of the possibilities of bone transplantation, a surgeon need not fear to go to the utmost limit with the curette. Perhaps in Kimpton's case, it would have been better to transplant bone if the child had been older or an adult, but apparently the re-formation of bone in his case is progressing rapidly. In DaCosta's case where I resected the inner condyle of the femur I would now add bone transplantation. Although the patient has good function, I think bone transplantation would have added to the strength of the joint. In the case in which I excised the recurrent tumor in the lower end of the radius and transplanted into the defect a piece of the ulna, I would to-day leave the ulna intact and transplant a piece of the tibia into the radial defect. This would promise equally good function without shortening.

In Wm. J. Taylor's case in the lower end of the femur, it is my opinion that he would have been justified in attempting a second curetting and filling the cavity with transplanted bone.

MEDULLARY GIANT-CELL SARCOMAS WHICH HAVE REMAINED WELL AFTER RESECTION IN CONTINUITY.

The first resection for giant-cell sarcoma in the Johns Hopkins Hospital was performed by Dr. Halsted in 1893. The tumor in this case was, however, a periosteal giant-cell sarcoma surrounding the lower end of the ulna. The patient was a colored woman aged forty-five; there had been pain localized in the lower end of the ulna one year, and then swelling. The tumor pulsated. In resecting the tumor Dr. Halsted removed the lower end of both radius and ulna and the first row of carpal bones. The tumor had in places invaded muscle. I found in one section giant-cells within a few millimetres of the border of the tissue removed with the knife. In this case the patient lived fifteen years after operation

without any signs of recurrence. After that I lost track of her. As shown in Fig. 15 there is a flail joint, but the patient worked for a number of years as a laundress, using this hand. This case, it seems to me, is good evidence of the benignity of a giant-cell sarcoma. Here we have a pulsating, infiltrating tumor, which has been removed with a very narrow margin of uninfiltated tissue. To-day, with our accumulated experience, I believe it would be possible in such a case to save the radius even if it were necessary to remove with the Gigli saw portions of the bone near the tumor and to transplant a piece of bone into the defect of the ulna.

CASE I (Pathol. No. 6125).—In February, 1905, Dr. Halsted resected the lower ends of both bones of the forearm for a giant-cell sarcoma of the lower end of the radius. This patient has remained well seven years. The function of the hand is not particularly good. When we study the X-ray (Fig. 16) from the view-points of our recent experience I think we are justified in concluding that the ulna could have been saved, the tumor resected, and bone transplanted. Such a procedure would have given the patient an equal promise of a cure with less mutilation.

CASE II (Pathol. No. 8680).—In January, 1908, Dr. Miller, then resident surgeon of the Johns Hopkins Hospital, resected the lower ends of both bones of the forearm and some carpal bones for medullary giant-cell sarcoma of the lower end of the radius. The X-ray picture does not differ from that of the previous case (Fig. 16). I studied the specimen sent to the laboratory most carefully: the tumor was everywhere most distinctly encapsulated; it could have been removed without injury to the ulna, and bone could have been transplanted.

The medullary cavity of the lower end of the radius seems to be a very common situation for this giant-cell sarcoma—in 9 out of 23 of the personally studied cases the tumor has been situated here. In four of these cases amputation was performed, of course, unnecessarily. In two of these, I am confident from my study, curetting would have been sufficient; in the remaining two resection would have been indicated,

as the bone shell had been destroyed by the disease. In two cases the local resection was too extensive in that the ulna was unnecessarily removed. One most favorable case refused the suggested amputation. Unfortunately I have been unable to follow this patient. The case curetted by Dr. Chambers is well, and the functional result is perfect. The patient, in whom I transplanted the ulna into the radial defect after removal of the recurrent tumor, has a much better functional result than was achieved in the two cases in which the ends of both bones of the forearm were removed.

The study of these nine cases of medullary sarcoma of the radius from the first amputation in 1895 to the first curetting in 1908 is a good historical review of the development of our knowledge of the disease and of its treatment without mutilation.

CASE III (Pathol. No. 10975, operator Bloodgood, November 11, 1910).—Resection of the upper third of the tibia with later transplantation of a portion of the split tibia into the defect with the transplantation of the articular surface of the patella in an attempt to make a knee-joint.

This case has many points of interest and is instructive in the development of the technic of bone transplantation. The patient was a white female aged twenty-six. Three years and three months before she came under my observation she began to have pain referred to the head of the tibia; at first the pain would be present a day and disappear. Now and then it would keep her awake a few hours at night. These attacks of intermittent localized pain continued for one year, and she was treated for rheumatism.

In the cases of sarcoma of bone without the history of a trauma this localized pain is the usual symptom of onset. The patient had sufficient pain to consult a physician, yet no one suggested an X-ray. At the end of the year she noticed a swelling of the upper end of the tibia. There was no restriction of joint motion. One year and three months after the onset of pain the patient consulted Dr. H. E. Ashbury, of Baltimore, through whose courtesy and interest I later was given opportunity to treat this patient. Dr. Ashbury took an X-ray and found a localized focus in the

upper end of the tibia. He does not remember its exact location, but feels quite sure that it was below the epiphyseal line; it was situated in the cancellous bone and had a broad zone of uninvolved bone around it. Unfortunately this plate has been lost. If I could reproduce it here, it would become historical as the first X-ray of a giant-cell sarcoma before it had destroyed bone to the outer table. The patient then refused operation. The swelling continued, and when I saw the patient two years later there could be little doubt about the diagnosis of either a bone cyst or a giant-cell sarcoma. Fig. 17 is a photograph of the patient, Fig. 18 the second X-ray taken by Dr. Ashbury. There is nothing in the clinical picture nor in the X-ray to exclude a bone cyst. In some respects the abrupt expansion of the tibia and the X-ray shadow suggest a bone cyst. Before I explored the tumor I felt that the chances favored a giant-cell sarcoma, because in many places the bone shell had been entirely destroyed, and there was distinct parchment crepitation. There was no pulsation. On dividing the capsule I encountered the typical giant-cell sarcoma tissue which has been described in my previous communication. To curette this tumor would have left conditions identical with resection—the simpler procedure. I therefore divided the tibia below the tumor and dissected the tumor capsule from the surrounding muscle without injury to nerves or vessels. The articular cartilage of the head of the tibia had to be removed, because it rested upon tumor tissue, as shown in Fig. 19. This resection was a simple procedure; it required some time, however, after removal of the Esmarch to check all the bleeding points, and, in view of the patient's condition, it was decided to close the wound and transplant bone later. The patient was a bad subject for operation, as she was nursing a child and had secondary anæmia associated with intestinal parasites. The wound healed *per primam*. On December 3, 1910, about three weeks later, when the patient's condition had greatly improved, I opened the wound which had healed well, exposed the remaining portion of the tibia, divided it longitudinally until I had a piece long enough to fill the defect, sawed off the head of the fibula, sawed off the articular surface of the patella, placed this patella on top of the fibula and transplanted the piece of tibia so that the articular surface of the patella rested against the condyle of the femur. These bones were fixed in position with wire and screws as shown in the

diagram (Fig. 20). I divided the piece of the head of the fibula in half and fixed these two pieces (see diagram) in order to observe their behavior. This wound also healed *per primam*. Fig. 21 shows the X-rays taken some weeks after operation, and Fig. 22 the X-ray taken May, 1912, one year and six months after operation.

There is no doubt in this case that new bone has formed from all the transplanted pieces. Although I sutured the patellar ligament to the transplanted piece of tibia, the patient has very little active extension (Fig. 23), but her chief difficulty is a slightly flail joint from weak lateral ligaments. She, however, gets about very well with a supporting apparatus, without crutches, and does not wish any further attempt to improve function. I am confident now, that with transplantation of fascia we could increase the strength and function of this knee-joint. I think this case demonstrates that we can resect very long continuous pieces of the long pipe bones with the joint surface, filling the defect with transplanted bone and fascia, and thus give the patient a very serviceable limb. The technic of this transplantation in the upper extremity is less difficult than in the lower, but it is gradually being worked out.

CASE IV (Pathol. No. 11855, operator Bloodgood, August 3, 1911).—In this case a tumor of the upper end of the fibula was resected. Fig. 24 is the X-ray taken before operation, Fig. 25 shows the specimen removed from a position similar to that in Dr. Chambers's case (Figs. 7, 8, and 9) which he curetted. But in this case there was less bone shell and for this reason no object in curetting. There was no periosteum to re-form bone. The dissection preliminary to resection was the simpler procedure, and I did not think it necessary to transplant bone into the defect (Fig. 26). I had had an experience with osteomyelitis of the upper end of the fibula in which the entire upper end of the shaft had been destroyed, and the bone did not re-form after the removal of the sequestrum and drainage of the abscess. Yet this patient had no weakness of the leg and suffered no inconvenience, except from a toe-drop due to injury of the external popliteal nerve, from

which he gradually recovered. Although I carefully exposed the nerve in this case of giant-cell sarcoma, I must have had too much tension on it during the dissection, because after operation the patient had all the sensory and motor signs of paralysis of the external popliteal nerve. Dr. Chambers informs me that in his case in which he removed the tumor with the curette from the upper end of the fibula, the patient shows paralysis of the external popliteal nerve. Both patients walk well.

These three cases demonstrate that for a tumor in the upper third of the fibula it is not necessary to transplant bone into the defect after the resection. However, if the continuity of the bone can be preserved by removing the tumor with the curette, there is no reason why curetting may not be attempted. But it should be remembered that in this locality complete removal of the bone has no functional disaster, so one need run no risks with curetting.

CASE V (Pathol. No. 12474, operator Bloodgood, February 23, 1912).—Resection of the lower end of the ulna; transplantation of piece of ulna into the defect. Good functional result.

This case is of interest in presenting the question of the relation of trauma to sarcoma. The patient was referred to me by Dr. George Ben Johnston, of Richmond, Va. He is a white male aged forty-eight. In June, 1911, about eight months ago, without any previous symptoms, he sprained the right wrist by a twist while cranking an automobile. There was no contusion. For at least two months he continued to have discomfort in this wrist, chiefly in supination. With these symptoms an X-ray was indicated, but he had not consulted a physician. He, therefore, had not been educated to the importance of an X-ray picture after a simple sprain. In November there was a second injury while he was lifting a box. The discomfort was of shorter duration. In December there was a third sprain. As the symptoms after this last injury did not subside, he consulted a physician, who treated it as a sprain. Here the physician had not been educated to the importance of an X-ray investigation. January 6 the patient noticed a swelling. This frightened him and his physician, and the X-ray was taken. (Fig. 27.) Case III, as I have stated, pictures clearly the importance of persistent localized pain in a

bone or joint as a symptom which should make X-ray examination imperative. This case illustrates the importance of an investigation with the X-ray when the symptoms of a relatively slight injury do not disappear quickly. Both laity and the profession must be informed of these facts.

The operation in this case was very simple. The tumor (Fig. 28) had so destroyed the bone capsule that it seemed not worth the while to try the curette. If this tumor had been in the radius, I should have attempted it. The resection was a simple procedure. The longitudinal division of the ulna with the Gigli saw was more difficult, but the shaft was split with the saw, and the piece transplanted and fixed as shown in the X-ray after operation (Fig. 29). This was done about three months ago. The period of disability was longer than if the tumor had been recognized earlier, at a time when it could be removed with the curette. The patient now has entirely recovered with good function.

It was this case more than any other factor which stimulated me to make this second report before this Association of surgeons. Although much has been written about the conservative treatment of giant-cell sarcoma, yet there seem to be but few surgeons willing to follow the advice. This patient told me that a number of members of the profession thought it was safer to have the arm removed; others rather favored resection, but preferred somebody else to do it. Then Dr. Coley, of New York, advised him to have the serum treatment before and after operation to prevent a recurrence. Quite naturally this patient is of the opinion that the American profession entertains radically different views in regard to the treatment of bone sarcoma, and I am quite confident that he will be anxious about the result for some years. I think I may confidently state that if this tumor had been removed from the lower end of my own ulna I should have no more anxiety about its recurrence than I would about the recurrence of appendicular attacks after the removal of my appendix.

CASE VI (Pathol. No. 12927, operator Dr. Emil G. Beck, of Chicago).—The tumor was situated in the lower end of the radius. Dr. Beck writes me that he considered the possibility of curetting, but as the tumor had destroyed so much of the

bone, he decided to do a resection. The X-ray before operation is shown in Fig. 30. It appears to me from the study of this X-ray that it might have been possible to remove the tumor with the saw and chisel, saving the uninvolved bone on the radial side as shown in the illustration and to transplant into the defect a piece of bone taken from the uninvolved shaft of the radius above.

Cases of Medullary Giant-cell Sarcoma which have Remained Well After Resection in Continuity, Collected from the Literature.

NASSE: Patient aged 49; symptoms six months; tumor in lower epiphysis of tibia. Well five years after operation.

GEBAUER: Patient aged 22; duration of symptoms not stated; situation lower end of radius. Well six years.

GEBAUER: Patient aged 12; situation lower end of radius. Well four years.

HAHN: Patient aged 20; situation head of humerus. Well 12 years.

KUDLEK: Patient aged 25; symptoms 18 months after trauma; situation patella. Well two years.

BLECHER: Patient aged 21; symptoms six months after trauma; situation humerus. Subperiosteal resection. Well 18 months. This patient had a pathological fracture three days before operation.

MORTON: Patient aged 40; symptoms six months; situation upper one-third of tibia. Well one year and three months.

MORTON: Patient aged 39; symptoms six months; situation upper one-third of tibia. Well six months.

MORRIS (reported by Morton): Lower end of radius. Well 13 years.

LUCAS (reported by Morton): Lower end of ulna. Well ten years.

SUTTON (reported by Morton): Sternal edge of clavicle. Well four years.

CLUTTON (reported by Morton): Lower end of radius. Death 18 months from nephritis.

CLUTTON (reported by Morton): Radius. Well two years.

KOCHER: Patient aged 18; situation ulna. Well 17 years.

KOCHER: Patient aged 19; situation radius; resection of radius and ulna. Well 7 years.

CASES OF MEDULLARY GIANT-CELL SARCOMA WHICH HAVE
RECURRED AFTER RESECTION IN CONTINUITY.

Among my 23 personally-studied cases I have one such observation (see Case II, Pathol. No. 8412, p. 222). In this instance there had been two curettings of a tumor of the lower end of the radius and one resection—apparently all three incomplete. I resected the recurrent tumor, transplanted a piece of ulna into the defect, and the patient has remained well five years since operation.

In the literature I can find but one case, reported by Kocher. The patient was aged forty-five; the tumor situated in the upper end of the left fibula. The head of the fibula was resected. One year later the leg was amputated for a recurrence. In the report (*Beitr. z. klin. Chir.*, 1906, vol. i, p. 135, Case 42) no details are given of the resection nor of the ultimate result after the amputation. It is stated that the tumor was a giant-cell sarcoma. The X-ray (Plate VI, Fig. 5) shows a small expanding tumor in the head of the fibula with a thin bone shell. The picture resembles very closely my case at the lower end of the ulna (Figs. 27, 28, and 29).

In the microscopic study of the case, in which I resected the upper end of the tibia (Figs. 17, 18, 19, 20, and 21) and later transplanted bone, I found the tumor had infiltrated muscle beyond its capsule. I disinfected this wound, before removing the Esmarch, with pure carbolic acid followed by alcohol. I felt at the time of the resection that I gave the tumor a very narrow margin at its lower end, so that at the second operation for transplantation I resected this piece of bone with the surrounding granulation tissue and muscle and redisinfected with the Paquelin cautery, followed by carbolic acid and alcohol. Microscopic study of this tissue shows the presence of giant-cells. Whether this means that the giant-cell tumor was still present, I do not know. They may be osteoblasts in granulation tissue. There has been no recurrence now one year and five months after operation.

In the first case in which I curetted the tumor from the upper end of the tibia (Case I, Pathol. No. 4520, Figs. 1 and 2) I found giant-cells in the granulation tissue lining the bone cavity, but there has been no recurrence now more than nine years since operation.

In Case IV (Pathol. No. 11855, p. 228, Figs. 25, 26, and 27) in which I resected the tumor from the upper end of the fibula, I found the giant-cell tumor in the muscle outside of the capsule.

The point that I wish to make here is this: In performing

resection, one should also disinfect the wound just as in cases after curetting. The indication for resection of a giant-cell tumor is the destruction of the bone capsule. When this happens, there may be infiltration beyond the capsule, and as it may be necessary to cut close to the capsule to avoid important nerves and vessels, it is quite possible that tumor tissue may be exposed.

Judging from the few recurrences, however, after resection this is a remote possibility, but I think it should be borne in mind, and the technic which I have always employed and described here should be followed.

CASES OF MEDULLARY GIANT-CELL SARCOMA SUBJECTED TO PRIMARY AMPUTATION.

Among the 23 cases of which I have records in the Surgical Pathological Laboratory, amputation was performed in nine. In four cases the tumor was situated in the lower end of the radius. I have already discussed and shown that amputation was unnecessary. In five cases the tumor was situated in the lower end of the femur. I am inclined to the opinion to-day that it would have been justifiable in some of these cases to attempt curetting with the transplantation of a piece of bone into the bone cavity. In every case, I am confident, resection would have given equal assurance of a cure and, with our modern methods of bone transplantation, a serviceable lower extremity. I have never had the opportunity to attempt curetting of this tumor in the lower end of the femur. Taylor, of Philadelphia, to whose case I have already referred, made such an attempt in 1906, but encountered so much hemorrhage that I doubt whether the curetting was really radical enough.

Kramer, whose case I have already recorded, was successful. His patient is well 12 years after the curetting of a tumor situated in the lower end of the femur. He does not describe his case in great detail, and there is no X-ray. He states, however, that the tumor at every point was surrounded by a bone shell; the tumor was composed of soft, vascular, red tissue, and under the microscope was composed almost entirely of giant-cells. It is quite possible that in Kramer's case only

one condyle was involved as in DaCosta's case, which, as has been stated, recurred after curetting, but remained well after resection.

The curetting of a giant-cell sarcoma from the shaft of the femur as done successfully by Karewski does not appear to me as difficult a procedure as when the lesion is in the condyles.

Hinds in his report (*British Med. Jour.*, Feb. 26, 1898; discussed by me in *Progressive Medicine*, December, 1899, p. 242) writes that the growth involved both condyles of the lower end of the femur and extended four inches up into the medullary cavity of the shaft. Hemorrhage in this case was controlled with an Esmarch. After curetting the surface of the shell of bone was scrubbed with a solution of chloride of zinc and the wound tightly packed. Six weeks later the cavity was again curetted and scrubbed with zinc chloride. This case reported as well two years and six months after operation demonstrates that curetting may be attempted in the lower end of the femur even though both condyles are involved. It also suggests that in extensive cases one may repeat the curetting and disinfection and then later hasten the healing of the bone cavity by bone transplantation.²

So far, in the literature, I have found only these two cases of Kramer and Hinds, in which curetting a tumor in the lower end of the femur was successful. Taylor and DaCosta, of Philadelphia, experienced recurrences, but perhaps their technic of curetting was not as radical. As I have noted before,

² Dr. Frank Hinds writes me under date July, 1912, that this patient, now almost seventeen years since operation, is free from recurrence. He works as a wheelwright, the limb is strong, but there is not much motion at the knee-joint, and there is a short sinus communicating with the old bone cavity which gives no discomfort. Dr. Hinds very kindly sent me a section from the original tumor—it is a pure giant-cell tumor. He also contributes a print from the X-ray taken under the date of the letter (see Fig. 33). I should consider this case perhaps the greatest triumph for curetting in the treatment of the giant-cell tumor, as it demonstrates that it is applicable to this tumor in the lower end of the femur even when both condyles are involved.

Taylor did not use an Esmarch and did not disinfect (see Fig. 31 of my previous report).

Among the 25 cases which I have collected from the literature, in only five was amputation performed primarily.

This evidence should support the chief contention of this contribution, that amputation is rarely, if ever, an operation of selection for giant-cell sarcoma. It might become an operation of necessity in those cases in which the tumor has infiltrated the soft parts to such an extent that radical removal would leave a useless extremity. As a matter of fact, this rarely if ever happened, except in very neglected cases.

The cases of giant-cell sarcoma which I have personally observed and which have been collected from the literature and considered in this paper may be summarized as follows: (1) cases cured by curetting, 11; (2) cases recurring after one curetting, cured by a second curetting, 1; (3) cases recurring after a curetting, cured by later resection, 3; (4) cases recurring after a curetting, cured by later amputation, 1; (5) cases which remained well after resection, 21; (6) cases which have recurred after resection, but remained well after amputation, 1; (7) cases subjected to primary amputation, 14.

I have been able, therefore, to study pretty carefully 52 cases. I am confident I could get a great many more from my colleagues in America. It is difficult to get the cases in the literature, except those reported under the title "Giant-cell Sarcoma." In such cases the operator has made the report because of his conservative treatment. Many of our cases were sifted from general reports from surgical clinics. I am confident that many of the cases of sarcoma of bone which have remained perfectly well after amputation belong to this group. After Dr. Wyeth's paper in Philadelphia in 1901, I tried to ascertain the pathology of the cured cases. It was very difficult, however. Fortunately one of the cases had been treated by Dr. Sherman, of San Francisco, and tissue had been preserved. It proved to be a giant-cell sarcoma. I am continuing this search and am inclined to the view that

if tissues are preserved in any of these cases, I shall find the tumor in the majority of cases to be giant-cell sarcoma.

In conclusion we may emphasize the following points:

1. Up to the present time we have no proof that the pure giant-cell sarcoma ever metastasizes. It is a question, therefore, whether it should be called a sarcoma.

2. Conservative treatment is justifiable. Curetting should, in some localizations of the tumor, be the operation of choice. But in those localizations where resection in continuity does not interfere with function, resection becomes the operation of choice; for example, upper end of fibula, lower end of ulna.

3. It is justifiable to attempt curetting to preserve function, even when conditions suggest a great probability of recurrence. There is no position where curetting is not justifiable as a first attempt. It has succeeded when the entire lower end of the femur was involved.

4. Among 26 cases subjected to curetting there were five recurrences: one has remained well after a second curetting; three after resection, and one after an amputation. I am confident that the number of successful cases of curetting will depend chiefly on the number of attempts.

5. Twenty-two cases were subjected to primary resection: one recurred and was cured by amputation.

6. As I found only five cases in the literature of giant-cell sarcoma subjected to primary amputation, and there are nine in my own list, one can feel pretty certain that many of these cases are not reported, except in statistical studies from large clinics.

7. After curetting or resection, the wound should be disinfected with pure carbolic acid followed by alcohol or chloride of zinc solution. The operation should always be done, if possible, under an Esmarch.

This procedure is not indicated because of the malignancy of the giant-cell tumor, but because in curetting we leave cells and disseminate cells, while in resection we may inadvertently cut into the tumor. There is apparently no danger in recurrences, except that they subject the patient to a second operation and perhaps more mutilation.

8. It is not necessary to perform the bone transplantation at the primary operation unless a single bone like the humerus or femur is divided in its continuity. In simple cases there is no reason why the transplantation should not be performed at the same time, but in some cases the resection may be tedious and bloody, and the patient may not be in good condition. In such cases it will be safer to transplant at a second operation.

9. I think I am the first to recommend and to practise direct transplantation into the bone cavity after curetting (Figs. 31 and 32). I am sure that this procedure will grow in value and importance as we attempt curetting more frequently.

10. My experience teaches me that it is simpler, when possible, to get the bone for filling the defect by splitting the bone which has been resected. This can be accomplished through a single wound. When this cannot be done on account of the large defect, one can remove the upper third of the fibula without injury to the function of the limb, or chisel large pieces from the tibia without destroying the continuity of the bone.

11. In every case in which the X-ray shows a medullary shadow the urine should be examined for Bence-Jones bodies; the latter indicate the presence of a multiple myeloma, or metastatic carcinoma.

12. I would caution against the surgeon making a positive diagnosis of either a bone cyst or a giant-cell sarcoma. The more X-rays I see, the less confidence have I in my ability to make a differential diagnosis, except in the later stages.

13. The positive diagnosis must be made at the exploratory incision. The bone cyst as a rule can be recognized by its blood-stained contents; the giant-cell sarcoma by its red, vascular tissue, which looks like granulation tissue. But the giant-cell tumor often has white areas of *ostitis fibrosa* and the *ostitis fibrosa* often red giant-cell areas. The two are often mixed. One tissue, however, predominates. The less experienced surgeon should always aid himself with a frozen section. The giant-cell tumor occurring as a blood cyst may

be encountered, as in Davis's case. The rare bone aneurism discussed in my previous report will be difficult to differentiate from the giant-cell tumor of the type described by Davis. Since my first report I have had one other observation in which the hemorrhagic tissue forming the wall of the blood cavity resembled closely a giant-cell sarcoma, but the frozen section demonstrated the practical absence of giant-cells.

From this investigation it is my opinion that it might be well to drop the term "giant-cell sarcoma," as it gives a wrong impression of the malignancy of the lesion, and use, at least temporarily, the designation "giant-cell tumor." F. B. Mallory, of Boston (*Jour. of Med. Research*, 1911, vol. xxiv, p. 463), is also of the opinion that it is a question whether this giant-cell tumor should be called a sarcoma.

In the gross and microscopic studies of benign bone cysts, osteitis fibrosa, and this giant-cell tumor, I am forced to the conclusion that there may be some relationship between these pathological processes. Very frequently, in the bone cysts and osteitis fibrosa, we find, in the gross, currant-jelly areas which cannot be told, under the microscope, from the giant-cell tumor, and in the latter we often find white areas histologically identical with osteitis fibrosa. At the present time the majority of investigators look upon the bone cyst and osteitis fibrosa as an inflammatory lesion. Perhaps the giant-cell tumor is a further pathological process in this as yet obscure bone condition.

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THE RADICAL OPERATION FOR THE RELIEF OF CANCER OF THE RECTUM AND RECTOSIGMOID.*

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THE true rectum lies between the levator ani muscle and the third sacral vertebra and consists of the so-called second part of the rectum, as designated by American authors. It is derived from the cloaca, which is a highly differentiated part of the hind gut, and has five sources of blood supply, all of which may be accompanied by lymphatics. The superior rectal and the middle hemorrhoidal arteries contribute the main blood supply, however, and the lymphatics, which are scanty, usually pass along with these blood-vessels by way of the rectal, sacral, mesosigmoid, and internal iliac glands to the juxta-aortic group.

The rectum proper has no mesentery and only a small part of its anterior surface is covered by peritoneum; it lies in the fatty supporting tissue inside the rectal fascia between the genito-urinary organs ventrally and the sacrococcygeal frame-work dorsally. Carcinomata of the true rectum are covered by peritoneum ventrally to some extent in more than half the cases. The type is adenocarcinoma.

The so-called first portion of the rectum has been shown by Treves¹ and Jonnesco² to be the terminal portion of the sigmoid derived directly from the hind gut, and its lymphatics pass to the aortic group by way of the mesosigmoid, following its single source of blood supply. All the growths in this situation are covered by peritoneum ventrally. The type is adenocarcinoma. Only 24 per cent. of rectal cancers lie completely below the peritoneum (Tuttle³).

The so-called third portion of the rectum is derived from the ectoderm or skin fold, and its lymphatics drain into the

* Read before the American Surgical Association, May 29, 1912.

inguinal and coccygeal glands as well as upward into the rectal glands. The anal canal is about one and one-fourth inches in length, contains no glands, and is lined by pavement epithelium. This part is the primary source of malignant disease in about 6 per cent. of the cases of cancer of the rectum. The type is epithelioma.

Operation for cancer has two principal objects: (1) complete removal of the local focus with such adjacent tissue as might possibly be affected, and (2) the removal, to as great an extent as possible, of the tributary lymph-nodes. To accomplish these objects in operating upon the true rectum for cancer means the removal of the entire organ with such a destruction of the muscles and nerves as will probably render efforts at securing a controllable anus impossible. While a brilliant result is occasionally obtained by drawing the sigmoid downward and passing it through the muscles of the anal canal from which the mucous membrane has been removed, such fortunate instances are rare. In most cases there results a preternatural anus at the normal situation, and this latter condition cannot be considered a restoration, but merely a sentimental attempt to place what amounts to colostomy at an unfortunate situation—the anal site. This is especially true if the muscles and nerves have been seriously damaged; in such cases an abdominal colostomy or a sacral anus will give as good or better results at a smaller risk. However, each case must be judged on its individual merits; an attempt to conserve function must not be allowed to result in failure to eradicate the disease.

Handley ⁴ has shown that carcinomatous implantation may be found in the bowel six inches above the visible expression of the disease. Fagge ⁵ has demonstrated, in two cases, an extension downward into the lymphatics of the anal canal without *visible* involvement of the canal itself. In Fagge's opinion, with which I agree, the entire anal canal should be removed when the carcinoma has its origin in the rectal ampulla.

The necessity of a wide eradication of the disease with at

least six inches of apparent sound bowel above and not less than two inches below, with all the surrounding fat and glands, usually means a permanent colostomy in some situation. The functional incapacity following the operation must be accepted by the patient as the price paid for the cure. Occasionally a case may be found early enough so that the disease can be removed locally with success. In five instances in the clinic in St. Mary's Hospital cancer of the rectum was discovered early enough to enable us to remove the focus by a purely local operation and no recurrence followed. In a few of our cases the strictly local nature of the disease seemed to justify a limited resection of the rectum with direct suture in continuity, but in the greater number of cases such operations cannot be considered, as they either subject the patient to an operation which is not radical and gives but a faint hope of cure or greatly increase the danger of sepsis from leakage.

Failure to remove the disease in an orderly manner, and not the natural tendencies of rectal cancer, is responsible for the pessimism of the profession toward the radical operation for removal of malignant growths in the rectum and rectosigmoid.

High-lying carcinomata of the rectum, in the so-called first portion of the rectum, in the large majority of cases can be considered to have their origin in the terminal sigmoid. Since, in most of these cases, the rectum is involved in its upper portion and in all it must be removed to a great extent, it is wise to consider all high rectal and terminal sigmoid growths in one group as rectosigmoid. They form a very considerable percentage of carcinomata of the rectum, and when localized are extremely favorable for curative operation.

In a limited number of cases the sigmoid can be anastomosed to the lower rectum by the tube method after resection, but in a considerable percentage, and perhaps the majority, the disease involves the rectum extensively and an operation cannot be considered complete which does not remove the entire rectum and lower sigmoid.

Colostomy through the left rectus muscle, as advocated by

Lilienthal,⁶ gives good functional results, and, as contrasted with a preternatural anus in any other situation, is to be preferred. A colostomy in the rectus muscle can be controlled by a simple abdominal binder—the weight of the abdomen in the bandage making the gentle pressure that is necessary for closure. The rectus muscle is as controllable as the biceps, and temporary voluntary control is often obtained, even against gas and fluids. Iliac colostomy, on the contrary, is placed in a situation where pressure must be brought by a pad or some other artificial means; the control may be efficient but generally does not bear comparison with that obtained when the opening is made through the rectus muscle.

If the colostomy be done as a primary operation to be followed later by radical removal of the disease, it allows thorough evacuation of the bowels and careful cleansing of the distal fragment before undertaking the second operation. When it is considered that 90 per cent. of the deaths following operation are due to sepsis,⁷ the importance of this step cannot be over-estimated.

A sacral anus is fairly well controlled by proper apparatus, and the average patient is, for sentimental reasons, better pleased with a colostomy behind, as that after all is what a sacral anus amounts to, than with a colostomy in front.

Operability.—Carcinoma of the rectum and rectosigmoid remains a local condition until a late stage. I have never seen a case in which a locally removable carcinoma in this situation has been inoperable because of glandular metastases alone. We have not infrequently seen cases which were locally removable and fairly free from glandular metastasis, but in which the liver was involved in embolic carcinoma. This is especially true in the young. In a few instances we have seen peritoneal metastases and implantation carcinoma in the mucous membrane both above and below the primary seat of the disease in cases locally operable.

In many cases rectal examination will not determine whether or not the disease be locally removable, and, since it

is essential to know that there are no irremovable metastases in the abdominal cavity, an intraperitoneal exploration should constitute the first step in operating on cancer of the true rectum and rectosigmoid, and not until this be done and the disease viewed from above can the question of rectal conservation be settled. This, however, should not be considered an arbitrary law. In the very obese, the cachectic, and those in poor physical condition from general diseases a single operation by the perineal or sacral route may be preferred to a method which requires two operations, although an occasional patient may be operated upon radically who has abdominal metastasis unknown to the operator because unexplored.

Inoperability is usually due to extension anteriorly to the region of the genito-urinary organs. When the mucous membrane of the bladder is affected and there is mechanical difficulty in micturition, an operation is not only futile but has also considerable mortality.

Involvement of the peritoneum and muscular coats of the bladder is not unfavorable to operation, and on a number of occasions we have removed a part of the bladder wall down to the mucosa with good results. Involvement by direct extension to the uterus does not mean inoperability. If necessary, the uterus with both ovaries and tubes can be removed at the same time. This was done in five of our cases. Carcinomata implanted upon the ovaries and pelvic peritoneum, however, are much less favorable for operation. The very fact that these carcinomatous cells have been loose in the peritoneal cavity means that other organs may be involved, although, on account of the rapidity of the progress of the disease in the ovaries, they are the only organs manifestly affected at the time.

The prostate and seminal vesicles, when involved in the carcinoma, can easily be removed to such an extent as may be necessary, but the prospect of cure is poor. In one patient we removed an inch of the posterior urethra and a piece of the bladder, followed by direct suture; the prostate and right seminal vesicle were also removed. The patient recovered

with control of the bladder. We have dissected the ureters from the bladder to the brim of the pelvis in a number of cases, and after covering them with vaseline, have allowed them to drop back into position. Ureteral fistula has not followed in any of these cases. We have found that if the ureters are thoroughly covered with vaseline after separation and denudation, both in this operation and the complete abdominal hysterectomy of Wertheim, ureteral fistula has not occurred. Gauze should not be allowed to come in contact with the denuded ureter in the drainage. It has been said that few cases of cancer of the rectum are operable beyond nine months after the beginning of the symptoms. This is an error. A number of our cases in which the symptoms had existed more than two years proved to be in excellent condition for operation. Much of the reputation of colostomy as a palliative operation depends on the fact that cancer of the rectum is a slow process and long remains a local disease. These extensive operations, however, can only be made with a justifiable mortality where a preliminary colostomy has been done and the rectal fragment has been carefully cleansed.

Two years ago I presented a report of 120 cases of resection of the rectum.⁷ Since then we (C. H. and W. J. Mayo) have operated on 71 additional cases. I wish briefly to review these with special reference to the operative methods and immediate mortality, reserving the question of ultimate results for a future report.

For convenience, the 71 cases submitted to radical operation from January 1, 1910, at which time the former statistics ended, to April 1, 1912, have been divided into two series:

(1) Operations through a perineal or posterior incision in a single stage; (2) operations through the abdomen or abdominal combined with a perineal or sacral incision in one or two stages. Each will be discussed separately.

I. OPERATIONS THROUGH THE PERINEUM OR A POSTERIOR SACRAL INCISION IN A SINGLE STAGE.—In this series there were 27 cases with 2 deaths (7 per cent.).

(a) *Local Operations*.—It is the rule in our clinic that the rectum shall be examined digitally in practically all of the cases in which an abdominal or pelvic complaint exists, whether or not there be rectal symptoms. Thus we have, on five occasions as previously mentioned (two in this group of 71), discovered carcinoma as a small localized mass from the size of a bean to that of a filbert, in patients with few or no rectal symptoms. Two of these were in degenerating polyps. Under an anæsthetic and after careful dilatation of the sphincter, a clamp was placed in such a manner as to bring up the growth with a wide zone of normal mucous membrane. The carcinoma was cut away with scissors and the base slowly seared with a hot iron. In one case it was necessary to use a catgut suture in addition. These five patients have all remained well.

(b) *Cripps's Perineal Resection*.—In this group there were five cases with no deaths. All involved the anal canal. The tumor, with a good margin of skin about the anus, the sphincters and a wide area of fat, the anal canal and a sufficient amount of the ampulla of the rectum were removed. The rectum above was not loosened from its bed and no attempt was made to unite the skin to the stump of the rectum. With a little care in the use of bougies in the third and fourth week, to prevent contracture, the functional results were excellent. In two of these cases the inguinal glands were removed at the same time. Undoubtedly it is good practice to remove the inguinal glands in all of these cases.

(c) *Quenu-Tuttle Perineal Resection*.—In this group there were 12 cases with one death ($8\frac{1}{3}$ per cent.). This operation is most properly applied in women. It consists, with or without removal of the coccyx, of a rapid dissection of the entire rectum from the hollow of the sacrum through a posterior straight incision. The dissection is extended anteriorly until the peritoneal cavity is opened. A gauze pad is placed inside the peritoneal cavity. The entire rectum is separated from its lateral attachments, which are caught in the forceps much as are the broad ligaments in vaginal hyster-

ectomy. Compression in the clamps for a few minutes, as pointed out by Bevan,⁸ stops all tendency to bleeding from the hemorrhoidal vessels. As a rule the entire mass can now be drawn through the incision with little difficulty. The superior rectal artery is tied and the proximal stump of sigmoid cauterized with the Paquelin cautery. In many cases the anal canal can be saved, and after stripping of its mucous membrane the lower end of the tied sigmoid is drawn through and fastened. We have followed Peck's⁹ advice, leaving the stump closed for from 24 to 72 hours before opening, and have obtained primary union in some cases. The patient is operated in the perineal position. This operation is indicated in very fleshy, elderly females in whom any kind of an abdominal operation would be fraught with great difficulty and danger, and in patients who are cachectic and anæmic. Of these 12 cases, two were extremely anæmic from continued loss of blood, one having 22 per cent. hæmoglobin and the other 28 per cent. Both made good recoveries. In the male this method does not give a sufficient view of the genito-urinary apparatus. In the female the bladder is protected by the uterus and vagina.

(d) *Posterior Resection of the Kraske Type* (Fig. 1).—Eight primary operations were made by the posterior route with one death, and 30 secondary to an abdominal operation with four deaths. This method as a primary one-stage operation was chosen in fleshy males and in several females with strictly localized growths well above the anal canal. In five the tied end of the sigmoid was drawn down through the anal canal, which was stripped of its mucous membrane. In three cases the functional results were good. In two the end of the sigmoid sloughed and separated from the muscles and the functional results were poor. In one, a rectosigmoid growth, direct suture in continuity was made over a tube. A sacral anus was made in the remaining two cases.

In the posterior operation we have followed the plan of putting the patient on the operating table in the reverse Trendelenburg posture (Fig. 1), closing the anus by suture

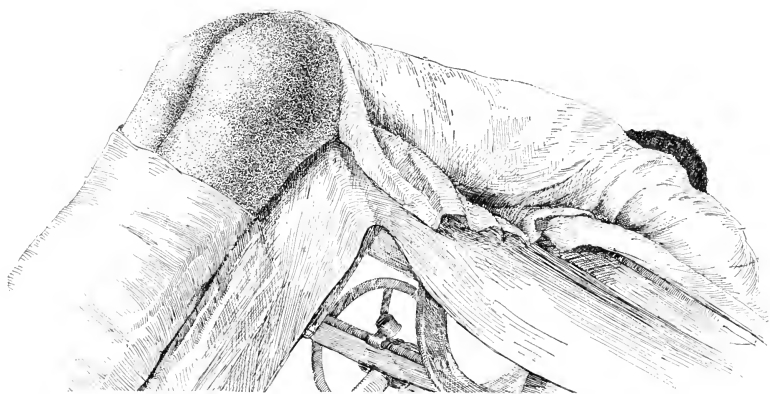
and making an incision in the posterior mid-line eight or nine inches in length from the upper sacrum to the anus. The coccyx and the fourth and fifth sacral vertebræ are removed, which gives a fairly good operative space (Fig. 2). The dissection is then made usually from below upward. It should be accurate and anatomic, exposing the posterior urethra, prostate, seminal vesicles, and posterior wall of the bladder in the male, the vagina and uterus in the female, and, as a rule, the ureters in both sexes. Hochenegg¹⁰ has had a large experience in posterior resections for rectal cancer. I have recently had the pleasure of seeing Prof. Hochenegg do his operation. In removing the fourth and fifth sacral vertebræ he makes the bone section slightly concave from below upward. He has no difficulty in removing growths which can be barely reached by the examining finger. In two-thirds of the cases operated a sacral anus is made. Five hundred cases have been operated in the Vienna clinic by the Hochenegg method with a mortality of 18.9 per cent. and 20 per cent. of five-year cures. In his private work, Hochenegg has a mortality of a little less than 10 per cent.

2. ABDOMINAL AND ABDOMINAL COMBINED OPERATIONS IN ONE OR TWO STAGES.—This series contains 44 cases with 9 deaths.

(a) *Abdominal and Abdominoperineal Operations in One Stage.*—There were 14 cases with 5 deaths in this group.† The lower sigmoid and rectum were removed through the abdomen or abdomen and perineum at a single operation. An incision is made in the mid-line, suprapubically, sufficient to admit the hand for exploration. The patient is elevated into a sharp Trendelenburg position and the incision is extended until it

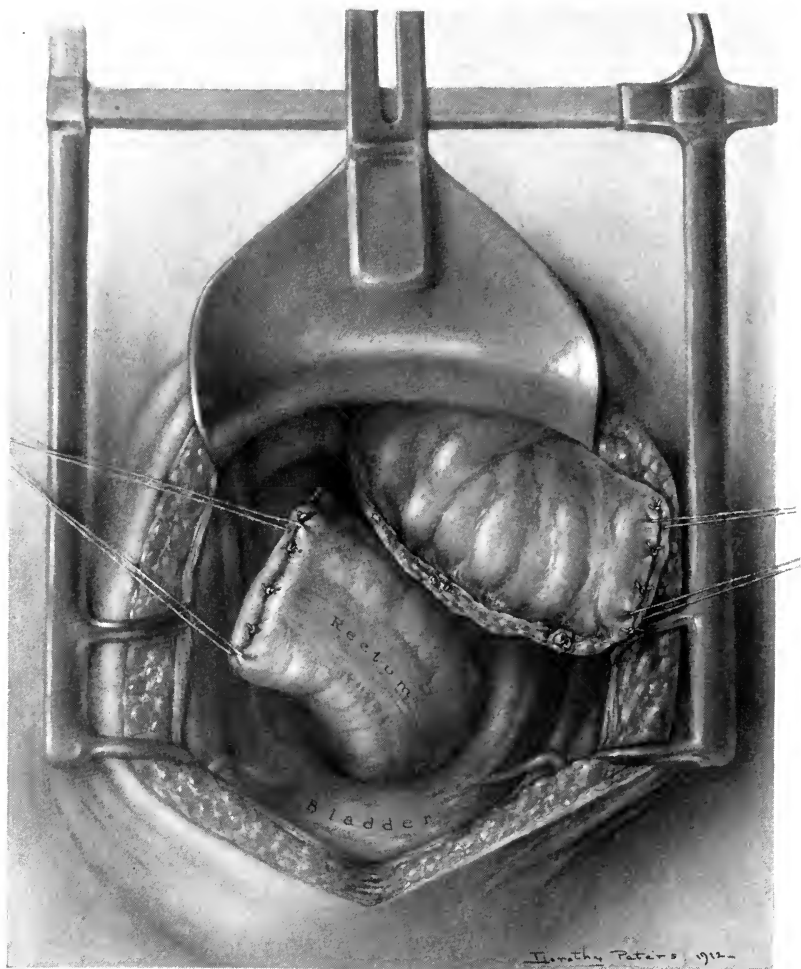
† The operative mortality is based on counting as a death from operation every case dying in the hospital without regard to cause of death, or length of time thereafter. Some of these deaths occurred from exhaustion and general debility several weeks after operation.

FIG. 1.



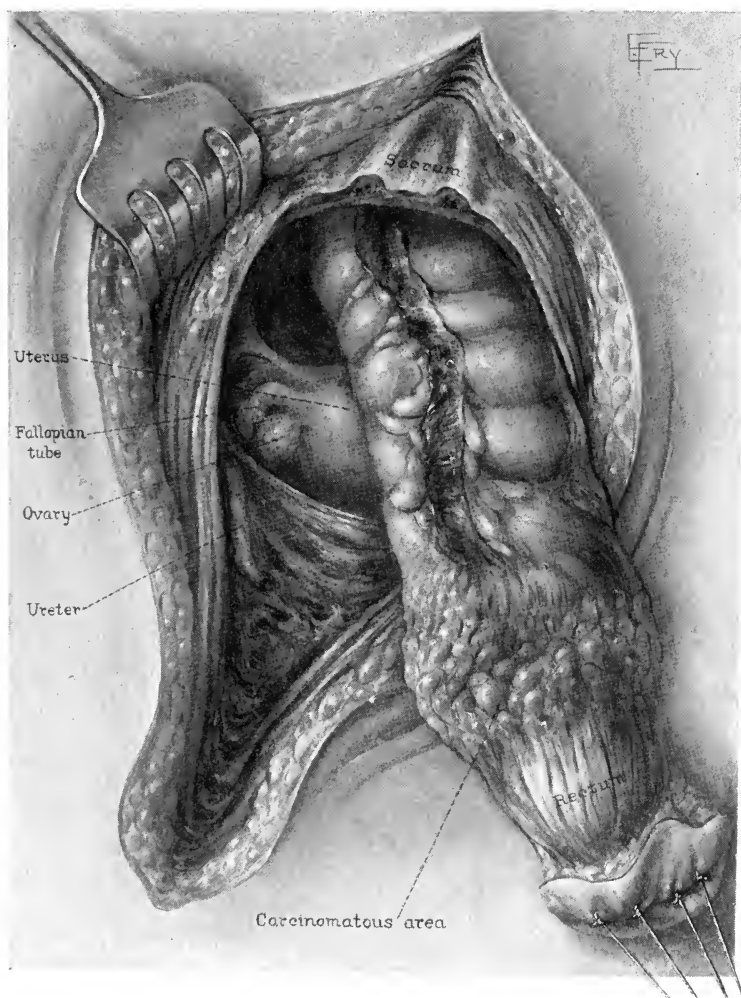
Patient in reverse Trendelenburg posture for excision of the rectum.

FIG. 2.



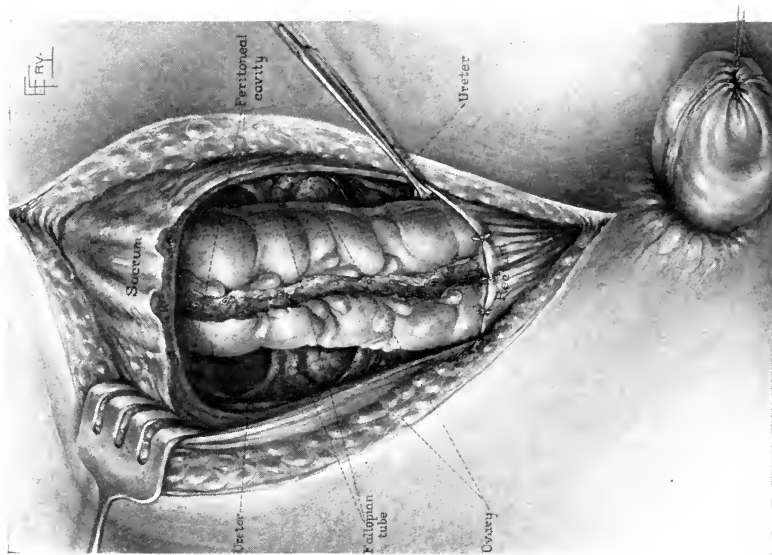
First stage of abdominosacral operation, division of lower sigmoid and permanent colostomy.
Second stage, removal of entire rectum and sigmoid to point of division, from behind.

FIG. 3.



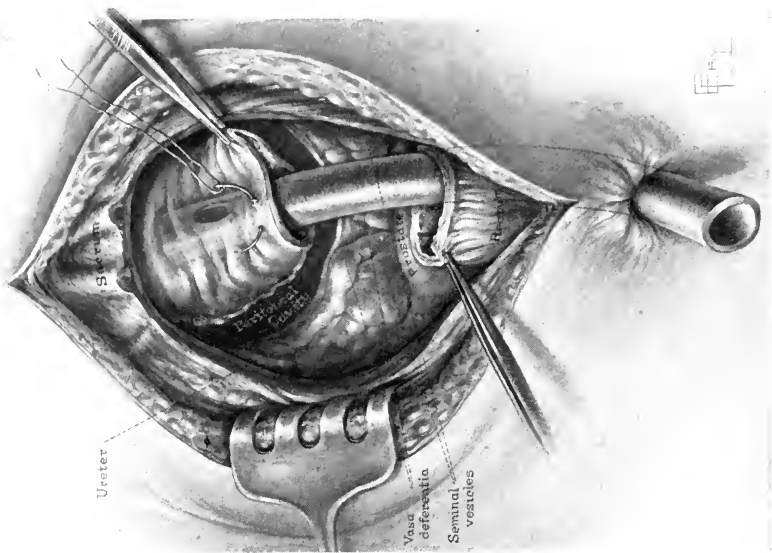
Posterior removal of rectum. Operation may be completed (a) by a sacral anus, (b) by closure of end of sigmoid if secondary to abdominal colostomy, (c) by removal of entire rectum and sigmoid to point of division if sigmoid be divided.

FIG 4.



Terminal muscular rectum conserved. Mucous membrane removed and end of sigmoid pulled through and out of anus. End of sigmoid left closed temporarily by a purse-string suture.

FIG. 5.



First stage of tube method of union of sigmoid muscular rectum, by posterior route. Rubber tube fastened to sigmoid by cauterized suture, to be followed by directed mucous suture and finally by invagination and suture.

FIG. 6.



Sagittal section showing union of sigmoid and lower rectum. Completion of tube method.

reaches from the umbilicus to the pubes. The sigmoid is drawn out and the abdominal cavity is carefully packed off with gauze. The sigmoid is clamped in two places at least six inches above the growth, firmly tied, and divided. The ends are sterilized with the actual cautery. The inferior mesenteric artery or the superior rectal, depending upon the point of division, is tied. Both ureters are identified and separated, the peritoneum rapidly divided, and the entire cavity of the sacrum quickly freed. The middle sacral artery will usually have to be tied, and the lateral sacral arteries should not be forgotten. These arteries have their origin from the posterior division of the internal iliac. The inferior pass down on the face of the sacrum and enter the lower sacral foramina. If roughly handled, unpleasant bleeding may continue from the foramina and may be difficult to check. The middle hemorrhoids are caught and crushed in clamps. By leaving the clamps on for a few minutes, they can be removed and bleeding will seldom follow. It is easy to separate the lower sigmoid and rectum down to the levator ani muscle. The technic may then be varied. When the patients were in poor condition, we have on several occasions put an angular clamp across the lower rectum at its deepest portion, then clamped the upper side, cut between, and sterilized the cut end which projected from the deep clamp with the actual cautery. The clamps were left on the handles projecting from the abdominal incision. The rectal space was packed with iodoform gauze which was brought out with the handle of the forceps. The wrist of a rubber glove was drawn over this down as far as the peritoneum of the bottom of Douglas's pouch, which was partly closed by sutures. The proximal end of the sigmoid was brought out as a permanent colostomy through a stab wound in the left rectus muscle and attached to the peritoneum on the inside by several sutures. Three out of four cases treated in this way recovered. They were advanced cases and the operation severe. In the remainder of this group the operation was completed through the perineum, removing the rectum from below. In four the end of the sig-

moid was brought down through the anal canal, which was stripped of its mucous membrane. In two, anastomosis of the rectosigmoid was done by the tube method ¹¹ (Figs. 4, 5, and 6), which we have found useful for carcinoma of the sigmoid higher up. In one of these two, a patient with marked obstruction, a preliminary lateral (iliac) colostomy was made and a week later the rectosigmoid was removed through the abdomen and anastomosed by the tube method. The preliminary colostomy enabled cleansing of the lower fragment and diverted the fæces until the rectosigmoid union was complete. The proximity of the colostomy was less embarrassing than might be expected at the second operation. The patient recovered. This method has merit where the true rectum is intact, and had we practised it in some of the cases that resulted fatally, I believe they might have been saved. In the remaining cases a permanent colostomy was done, the peritoneum being closed across the bottom of the pelvis as well as possible after packing the cavity with iodoform gauze, and bringing the ends out through the perineal incision.

(b) *Preliminary Colostomy with Secondary Posterior Resection.*—Thirty operations with four deaths (13 per cent.). There were a number of cases in this group in which acute, subacute, or chronic obstruction existed, and the majority, because of adipose tissue, cardiovascular changes, nephritis, etc., were poor surgical risks.

OPERATION.

First Stage.—An incision is made in the left rectus muscle and the abdomen carefully explored. A colostomy through the incision is then performed by the Lilienthal method. After union is complete, daily irrigation of the lower fragment is begun, washing both from the colostomy through the anus and from the anus upward until the lower segment is clean. The bowels are evacuated on the fifth or sixth day with castor oil.

Second Stage.—Seven to 12 days following the first

operation the entire rectum and rectosigmoid are removed from behind by the method described in *d*, Series 1 (Fig. 2). The end of the sigmoid is closed completely by suture and left as an appendage to the colostomy from which mucus can escape. This method has two commendable features: (1) the relief of the obstruction, and (2) careful preliminary cleansing of the part to be resected. The mortality was relatively low, and the prospects of permanent cure as good as in any other group of cases. The logic of results points to this method as the one of choice in the majority of cases of high rectal and rectosigmoid growths, but the last word is still to be said on this subject.

Where the growth extends high on the lower sigmoid the following variation in technic can be made: A mid-line incision is made suprapubically, the exploration completed, and the sigmoid brought up and divided between two ligatures and both ends sterilized (Fig. 3). The distal end is invaginated into the bowel with a purse-string suture, and the superior rectal artery tied. The mesosigmoid is divided above the promontory of the sacrum, the peritoneum divided on each side as far as the bottom of Douglas's pouch, and the fat and glands separated from their posterior attachments to this point only. The distal end of the sigmoid with the attached fat and glands is depressed and the peritoneum closed down and over the top of the mass. The anterior peritoneal attachments to the bladder and the lateral attachments of the rectum and lower sigmoid are not disturbed because the main blood supply through the superior rectal vessel has already been cut off. The end of the proximal sigmoid is brought out through the middle of the left rectus muscle as a permanent colostomy. A tube must be inserted into the lower fragment through the natural anus to carry off the discharges and to enable cleansing by gentle irrigation. On the fifth or sixth day the bowels are thoroughly emptied by means of castor oil. On the sixth or seventh day a complete posterior resection is made, and the entire fragment from the anus to the point of previous section of the sigmoid is removed from behind as

described in *d*, Series 1. The patient should be kept on the side after the sacral operation, and not on the back. This is an excellent method but has an increased mortality over the method just described. It should not be practised in the very obese, nor in those with obstruction. We had one patient die several days following the colostomy from perforation of the lower fragment. We had no deaths from preliminary colostomy as usually performed.

In several instances the patient objected so seriously to a permanent colostomy that a lateral colostomy was made at the first operation sufficiently high on the sigmoid to permit later manipulation. At a second operation the end of the bowel was drawn down through the anal canal, which must always be stripped of its mucous membrane, and, after union was complete, the colostomy was closed. Since this second variation in technic depends on conditions which cannot be known until the abdomen is opened, consent must be obtained to make a permanent colostomy if essential. This method promises most for the future, as it gives the best prospect of a complete restoration of the continuity of the alimentary canal and rectal function with a small risk.

We are encouraged in contrasting the histories of these 71 cases with those of the 120 cases previously reported. While no one operation can be applied to all cases, and while more or less incomplete operations are sometimes found necessary because of the condition of the patient, the last two years have witnessed wider extirpation and more extensive operations generally. These now include an important group of cases heretofore considered hopeless. The two most important factors in these results are, first, elimination by means of preliminary abdominal exploration of cases of abdominal metastasis which would otherwise be subjected to unavailing and dangerous operations, and second, the acceptance of permanent colostomy, sacral or abdominal, as a necessary evil in the majority of cases.

In the 120 cases previously reported, the mortality was 16 per cent. In the present group of 71 cases the mortality

is about the same (15.5 per cent.), due to the acceptance for operation of cases which previously would have been considered hopeless.

In contrasting the various methods of operation, it can be seen that the operations grouped under Series 1 give the smallest mortality. In the elderly, in the very obese patient, and in poor surgical risks, operations in one stage through the perineum or posteriorly (sacral) should be practised. The sacral operation, either as a primary operation or as the second stage of the abdominosacral method, is the operation of choice for the actual removal of the rectum. The great advantage of this particular operation lies in the fact that the disease can be extirpated widely at a single operation if necessary. In over half of the 191 cases in our combined series, this type of operation was performed as a primary operation or as the second stage of the abdominosacral method.

The abdominoperineal combined method performed at a single operation is perhaps the ideal method. In the 14 cases of this type herein reported, there were five deaths. Miles¹² lost 17 out of 42 cases, Wallis¹³ gives a mortality of 40 per cent., and Hartmann¹⁴ lost one out of four cases, and Kraske¹⁵ four out of 10 cases. I am confident that were this method applied to all cases the mortality would be reduced one-half. It must be taken into consideration that the 14 cases subjected to operation in this series could not be done in any other way and were otherwise hopeless. The upper rectum and lower sigmoid were involved nearly to the promontory of the sacrum. In all a complete dissection of both ureters was necessary. Four of them had been operated previously and a colostomy made because they were considered hopeless. In two, a loop of adherent small bowel was coincidentally resected, and in two cases the uterus was involved and removed. Are operations justifiable in carcinoma advanced to this degree? Our experience leads us to believe that they are—we have a number of five-year cures in the 26 cases of abdominal and abdomino-combined operations in one stage in the previous series of 120 cases reported in 1910.

The combined abdominosacral operation in two stages has much to commend it and has a mortality of less than one-half that of the abdominoperineal combined operation in one stage. The ability to cleanse the lower fragment, and the relief of obstruction which a preliminary colostomy makes possible is of the greatest importance. This method also permits the removal of tumors of the most extensive description from the rectum proper, a situation in which the abdominoperineal combined operation affords insufficient access. The rectum can be dissected by the sacral route with as much precision as in the cadaver, and it is a suitable procedure for practically all growths of the rectum and rectosigmoid. Its greatest advantage lies in the fact that if a temporary colostomy be made to divert the fecal current until satisfactory union of the upper and lower fragments has taken place, in suitable cases complete restoration of normal function can be confidently expected.

We are to-day operating upon cases which three years ago we would have considered entirely beyond the reach of surgery because experience has shown that cancer of the rectum long remains a local disease, and by block dissection cure can be obtained in a goodly percentage of cases.

RESECTION OF THE RECTUM AND RECTOSIGMOID.

January 1, 1910, to April 1, 1912.

| | |
|--------------------|---------------------|
| Total number | 71 |
| Discharged | 60 |
| Died | 11 (15.5 per cent.) |

POSTERIOR AND PERINEAL OPERATIONS.

| | No. cases | Discharged | Died | Mortality Per cent. |
|-------------------------|-----------|------------|------|------------------------|
| Local operation | 2 | 2 | 0 | 0 |
| Harrison-Cripps | 5 | 5 | 0 | 0 |
| Quenu-Tuttle | 12 | 11 | 1 | 8 $\frac{1}{3}$ |
| Posterior (Kraske) | 8 | 7 | 1 | 12.5 |
| — | — | — | — | — |
| | 27 | 25 | 2 | 7 |

ABDOMINAL OR ABDOMINAL COMBINED IN ONE OR TWO STAGES.

| | No. cases | Discharged | Died | Mortality Per cent. |
|--|-----------|------------|------|------------------------|
| Abdominal and abdominoperi- neal: single stage | 14 | 9 | 5 | 35 |
| Preliminary colostomy with sec- ondary posterior operation in 2 stages | 30 | 26 | 4 | 13 |
| | — | — | — | — |
| Total | 44 | 35 | 9 | 20 |

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- ² Jonnesco: *Ibid.*
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- ⁴ Handley: Lond. Lancet, Jan. 14 and 28, 1911.
- ⁵ Fagge: Lond. Lancet, Feb. 28, 1911, p. 232.
- ⁶ Lilienthal: ANNALS OF SURGERY, vol. lii, 1910, pp. 384-387.
- ⁷ Mayo: ANNALS OF SURGERY, June, 1910, pp. 855-863.
- ⁸ Bevan: ANNALS OF SURGERY, vol. lii, 1910, p. 139.
- ⁹ Peck: ANNALS OF SURGERY, vol. li, 1910, pp. 242-245.
- ¹⁰ Hochenegg: Press Medical, Oct. 10, 1908; also, personal communication, May, 1912.
- ¹¹ Balfour: ANNALS OF SURGERY, Feb., 1910.
- ¹² Miles: Glasgow Med. Jour., Feb., 1912.
- ¹³ Wallis: Lond. Lancet, Jan. 28, 1911, p. 231.
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NEPHRECTOMY.

A STUDY BASED ON THE RECORDS OF 112 CASES.

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(Concluded from page 54)

TUBERCULOSIS.

Statistics.

| | Cases. | Deaths. | Percentage of Mortality. |
|------------------------------------|--------|---------|--------------------------|
| Primary nephrectomy | 7 | 4 | 23.5 |
| Secondary nephrectomy | 3 | 0 | 0 |
| Total percentage of mortality..... | | | 20 |

Four times nephrectomy was subcapsular, followed by no death. Altogether, ureterectomy was done seven times, six times as a primary, once as a secondary procedure.

Out of 20 instances of tuberculosis of the kidney, the specific bacillus was encountered in the urine only six times; 14 times it was absent, though either pyuria or hæmaturia, or both, were present. Among these 14 cases Koch's bacillus was found twice in the puncture fluid withdrawn from the fluctuating kidney tumor. Thus it appears that only eight times was the diagnosis incontestably positive. Ten times, though no tubercle bacilli could be demonstrated, the proper diagnosis was nevertheless made with fair probability. It was based on a tuberculous family history, on the presence of hæmaturia with a fluctuating tumor, on pulmonary signs of the malady, on stigmata of Pott's or other joint disease, but especially and in most instances on the presence of typical ulcers of the bladder. The Calmette and Von Pirquet tests gave additional aid. Twice only were all the signs generally justifying suspicion of tuberculosis entirely absent. Primary nephrectomy was done altogether 18 times, twice by the sub-

capsular method, and six times in conjunction with ureterectomy. In one only of these ureterectomies a second incision, one parallel to and above Poupart's ligament, had to be employed. In one case secondary ureterectomy became necessary. Secondary nephrectomy was done twice, not as a matter of choice but as a necessity; once because the patient's strength failed to an alarming degree very soon after the beginning of the operation, although a preparatory intravenous saline infusion had preceded it. In a second case there was also collapse, following a moderate arterial hemorrhage due to the giving way to finger pressure of a septum dividing two abscesses. The bleeding vessel was caught by a clamp, which was left *in situ* for three days. On the fourth day nephrectomy was done, when the brittle tissues of the pedicle were promptly cut through by the elastic ligature. By a lucky pass the retracted stump was caught and was secured by two silk ligatures applied with an aneurism needle.

As suppuration was present in almost every instance, careful watch was kept for injuries of the peritoneum, so as to guard against unobserved infection of the peritoneal cavity. Several times the peritoneum was purposely opened for the sake of exploration. Before proceeding to the delivery of the kidney, peritoneal rents or incisions were carefully sutured and protected with gauze packings. After removal of the kidney the wound was always immediately united up to the vent left for the exit of drainage except once. In this exceptional case necessary haste compelled us to pack the wound for the time being, and to close it later by secondary suture.

Out of the total number of 20 patients four died, all after primary nephrectomy. The causes of death were: suppression of urine, diphtheria of the bladder, general miliary tuberculosis, and acute anæmia due to loss of blood.

CASE LXIII.—*Tuberculosis of bladder, ureter and left kidney. Epicystotomy. Nephrectomy. Ureterectomy. Cure.* (*Hospital Reports*, 1901, p. 195.)

Harry S., age thirty-eight, admitted October 25, 1898. Family

history negative. Two years ago hæmaturia with vesical pain radiating to penis. Shortly afterward another attack of hæmaturia, followed for three months by frequent, painful urination, with tenesmus. Kept in bed for three months. Urine became and remained turbid. Lost much flesh and strength. On admission, fairly well nourished; rough breathing over both lungs. Temperature, pulse, and rate of respiration normal. Left loin sensitive to pressure. Urine clear, acid, 1022, albumin, pus, tubercle bacilli. October 29, cystoscopy. Trabeculated bladder; a bleeding, elevated ulcer in trigonum, which prevented ureteral catheterization. November 1, suprapubic cystotomy under chloroform. Ureteral catheterization; no urine from left side; that from right ureter showed no tubercle bacilli. Closure of suprapubic wound, which healed promptly. December 5, typical nephrectomy, individual ligature of vessels. January 20, no bacilli in urine. February 6, had gained seven and one-half pounds. May 2, ureterectomy down to within an inch of the bladder. June 12, still some vesical tenesmus; urine clear, acid, containing a few pus-cells. Discharged cured.

CASE LXIV.—*Tubercular pyelonephritis. Suppression of urine. Death.* (*Hospital Reports*, 1901, p. 198.)

Fanny L., age thirty-six, admitted June 13. Twelve months ago patient became pregnant. In the fifth month of gestation pain in left loin. Was delivered of a healthy child three months ago. Puerperium normal. As soon as out of bed, began to have former kind of pain. It begins in loin and radiates down toward left iliac region. Six weeks ago patient noticed turbid urine. Micturition frequent and painful. Examination showed a pale, poorly nourished woman. Occupying the left loin, a hard, movable mass. Slight œdema of the legs. Temperature 100°, pulse 110, respiration 24. Urine light colored, acid, 1006, albumin, many pus-cells. Urea 0.5 grain to the ounce. June 18, temperature 103°, pulse 110. Harris segregator introduced; cloudy, bloody urine from left side; purulent urine from the right. June 20, temperature 103.4°, pulse 108. Nephrectomy through oblique incision. Kidney much enlarged. Was aspirated, no pus found. Upon stripping off the capsule, a far advanced tuberculosis was seen; nephrectomy. Elastic ligature. Stimulating enemata given. June 21, temperature normal, pulse 100 to 112, respiration 26 to 32. Passed seven ounces of urine, half of which

was pus; vomited frequently. It was feared that the remaining kidney was failing. June 22, temperature 98.6°, pulse 108 to 125, respiration 24 to 32. Passed only one ounce of urine with much pus. June 23, pulse weak; infused a pint of salt solution. Only one-half ounce of urine secreted. June 25, passed one ounce of urine; pulse 120, full and strong. By phlebotomy four ounces of blood were withdrawn and one pint of saline solution infused. June 27, patient died at 4.30 A.M. No autopsy permitted.

CASE LXV.—*Multiple fibromata of right kidney (healed, or latent tuberculosis?). Nephrectomy. Cure. (Hospital Records, 1901, p. 329.)*

Edward P. S., fifty years old, merchant, admitted May 2, 1900. No tuberculosis in the family, pneumonia twelve years ago, had no gonorrhœa. Four years ago painful and very frequent micturition, lasting for several days, and recurring about every four months. In November, 1899, an especially severe attack compelling patient to remain in bed. Had then several severe chills, with high fever, acute pain in the right loin, very painful, scalding urination, and for two weeks passed bloody, dusky urine. Pain radiated from right loin into glans penis and rectum. A free interval of two weeks was followed by another attack, lasting again about two weeks. After this was examined by Dr. Swinburne at New York, who found abundant tubercle bacilli in the urine. Cystoscoped by Dr. Alexander, who found a normal bladder, and gained, by catheterization, a quantity of absolutely normal urine from the left ureter. Right ureter could not be entered; to its vicinity a plug of purulent looking mucus was found attached. The fluid in the bladder became so obscured that cystoscopy had to be discontinued. Cystoscopy was followed by a smart attack of orchitis, which ended two weeks after examination by the spontaneous discharge of a scrotal abscess. During hæmaturia, marked loss of weight; but in last three months the loss was recovered. On admission patient still complained of frequent urination and pain at end of penis, but lumbar pain had disappeared. Pulse, temperature, and respiration normal; fairly good condition. Thoracic and abdominal organs normal. Urine clear, acid, specific gravity, 1015, traces of albumin, no sugar; but pus-cells and bacteria. Daily search for tubercle bacilli negative. Patient suffered from intense dread of renal tuberculosis, and urged exploration, to which consent

was finally given. May 7, under chloroform, right kidney exposed and developed. Size and appearance normal. Vessels having been isolated and compressed, kidney was bisected. Glandular portions and calices normal, except that in cut surfaces of cortex four hard, whitish-yellow nodules, the size of a hemp-seed, were found, closely resembling miliary tubercle. No scars in calices or the pelvis. Vessels separately tied and severed; then ureter was isolated down to level of pubic bone, tied, and cut off. Healing of the wound rapid. Urine passed by urethra contained, for a few days, traces of albumin and some hyaline and granular casts, but was abundant, and patient was discharged cured on May 23.

Very careful examination of kidney revealed chronic interstitial nephritis with adenomatous changes of the parenchyma. The nodules noted at the operation, of which more were found in various sections, proved to be fibrous tissue, evidently the vestiges of a process that had reached its termination. Nothing characteristic of tubercle and no bacilli were found. Unfortunately the specimen had been placed in alcohol immediately after its removal, and no inoculation experiments could be made. The question, whether nephritis had originally been suppurative or tuberculous, had to remain undetermined.

CASE LXVI.—*Tuberculosis of right kidney. Nephrectomy. Cure.* (*Hospital Reports*, 1901, p. 342.)

Morris N., tailor, age thirty-six. Admitted June 6, 1900. Gonorrhœa 15, smallpox 13 years ago. Since two years frequent and painful urination, the act ending with escape of a little blood. No hæmaturia; passed water hourly during the night. Since five weeks urine turbid and foul. A dull, constant pain in right loin, much aggravated by exertion. No chills or fever. On admission, excellent general condition, muscular frame. Internal organs normal. In right loin a tender, hard body felt. Pulse, temperature, and respiration normal. Urine very turbid, with pus and tinged with blood, acid, albumin, no tubercle bacilli. June 8, nephrectomy, chloroform. Reflection of peritoneum identified, then injured, but immediately closed. Kidney small, several fluctuating areas; puncture gave pus. The situation very high, immobility pointing to very short pedicle. Subcapsular elastic ligature. Absence of parenchyma, four abscesses, swarming with tubercle bacilli; lining of cavities ne-

crossed. June 17, urine normal. July 10, ligature came away. August 11, discharged cured.

CASE LXVII.—*Tubercular pyonephrosis of right side. Nephrectomy, secondary ureterectomy. Cure. (Hospital Reports, 1903, p. 164.)*

Hyman G., tailor, thirty-nine years old. Five months ago was suddenly taken with severe chill, fever, vomiting, and suppression of urine, accompanied by pain in right side. Was jaundiced for two months. Feet have tendency to swell. During the past three months noticed increasing weakness and puffiness of feet. Had lost twenty-five pounds in weight. Noticed continuous pain in right side; urination painless.

On admission, December 3, 1900, lungs: retraction above both clavicles, dulness and râles over both apices. Heart normal. Liver slightly enlarged. Spleen normal. Slight kyphosis corresponding to eleventh dorsal vertebra. Right side of abdomen visibly bulging. Corresponding to this in the right hypochondrium, a large globular mass, reaching the median line, which can be bimanually manipulated. Colon can be felt and percussed passing over its lower pole. Tumor shows indistinct fluctuation. December 10, cystoscopy. Trabecular bladder; mucosa normal; left ureteral orifice normal; right ureteral orifice normal except for a surrounding capillary injection. Aspiration of tumor through loin yielded abundant seropus. Pulse 60-72, temperature normal or slightly elevated. Examination of aspirated fluid showed it to contain trace of albumin, pus, red blood-cells, and abundant tubercle bacilli. Urine, trace of albumin, no casts. December 14, nephrectomy. After free stimulation, oblique lumbar incision, exposure of peritoneal reflection, and development of the large, fluctuating tumor. This was much facilitated by evacuating several discrete abscess cavities. Tumor a large pus sac, renal elements absent. Renal vessels individually tied with catgut and divided. Thickened ureter exposed for the distance of about seven inches, divided, and distal stump tied with catgut. As the wound had been soiled by pus, a Mikulicz tampon was applied and the anterior angle was closed with button sutures. Intravenous saline infusion of 1000 cc.; pronounced chill, probably due to infusion. Slight febrile reaction. During the first three days passed between 15 and 20 ounces of urine daily. December 21, patient coughing. Tubercle bacilli found in sputa.

January 5, 1901, patient out of bed. Wound contracting. February 12, 1901, discharged with moderately secreting sinus. April 10, 1901, readmitted with persistent sinus and pain in right inguinal region; urination frequent and painful. Urine clear, no tubercle bacilli. Local treatment being unsuccessful, June 3, ureterectomy; excision of scar and extension of incision to Poupart's ligament. Detachment of ureter to within one-half inch of bladder, where it was tied and cut off. July 21, discharged cured, with urination painless though still somewhat frequent.

CASE LXVIII.—*Tuberculosis of left kidney. Nephrectomy. Cure. (Hospital Reports, 1903, p. 258.)*

Henry B., clerk, of Savannah, Ga. Family history tuberculous. Had suffered for six years from attacks of pain in left lumbar region, at times radiating downward into bladder and thigh. Urine was dark brown, malodorous, and cloudy, never bloody. Passed gravel four months before admission. Had lost weight. On admission, April 19, 1902, internal organs normal. Left loin tender and painful; no tumor. Urine acid, 1024; faint trace of albumin; few pus-cells; mucus; no tubercle bacilli on repeated examination; total amount of urine 35 to 40 ounces; urea, 2 per cent. April 21, 1902, exploration of left kidney under gas and ether. Development of the organ difficult on account of numerous adhesions, especially around upper pole. Kidney enlarged, lobulated; at its upper pole a fluctuating area which contained pus. Ureter much dilated. Nephrectomy. Vessels of pedicle separately tied. Ureter was stripped out of its bed as far as its pelvic portion, and then ligated and removed. Specimen: Large abscess at upper pole; several small cheesy foci in its vicinity. Ureter thickened, dilated, and constricted near its pelvic portion. Tubercle bacilli in pus. Uneventful convalescence. Discharged cured May 17, 1902.

CASE LXIX.—*Intermittent hydronephrosis of right side from kinking of ureter, lysorthosis; liberation and straightening out of ureter; improvement. Tuberculosis of hydronephrotic kidney. Nephrectomy. Cure. (Hospital Reports, 1905, p. 171.)*

Sophie S., age twenty-one, admitted December 30, 1903. Had been operated upon two years before for floating kidney. Had been entirely well until six months ago, when attacks of pain with scanty urine, set in; after cessation of each attack urine be-

came very abundant. Micturition frequent, urine clear, no cough. On admission, general condition fair, internal organs normal. During an attack at hospital, tumor was observed in right loin. By ureteral catheterization, right kidney, urine clear, acid, a few pus-cells, no tubercle bacilli, urea 0.9 per cent.; left kidney: clear, acid, a few red blood-cells and pus-cells; urea 0.7 per cent. January 1, 1904, under ether: upper segment of ureter found much dilated, tortuous and fixed by adhesions; renal pelvis dilated. Liberation of ureter from adhesions. Cessation of attacks and disappearance of tumor. February 9, discharged. February 23, readmitted, as constant lumbar pain, chills and fever, vomiting and frequent urination had set in after discharge. Lumbar tumor reappeared, very tender. Temperature 104.2° F., pulse 140, leucocytes 28,000. March 5, tubercle bacilli in urine. March 14, nephrectomy. Large abscess in upper pole. April 19, discharged cured.

CASE LXX.—*Tuberculosis of right kidney and ureter. Nephrectomy and ureterectomy. Death.* (*Hospital Records*, 1904-1905, iii, p. 499.)

Rachel F., age twenty-three, admitted February 28, 1905. Brother died of tuberculosis. Eighteen months ago hæmaturia, since then strangury and frequent bloody urine. Dulness of apices. In right loin a large tumor, extending to median line of abdomen and three fingers below umbilicus. Temperature and pulse normal. March 11, 1905, typical nephrectomy. Ureter stripped down and ablated close to bladder. Specimen: kidney 5½ inches long, 3½ inches thick and wide; pelvis distended by turbid serum, studded with miliary tubercles. Parenchyma much thickened and peppered with miliary tubercles. Ureter thickened and dilated. March 12, temperature 105° F. No pain; urine 41 ounces. March 17, continued high fever. Patient stated invariably that she felt well. Urine 50 ounces, clear. March 21, died. Autopsy: diphtheria of bladder.

CASE LXXI.—*Tuberculosis of right kidney. Explorative nephrotomy of left kidney. Nephrectomy of right kidney. Prolonged suppuration. Incision of perineal abscess. Improvement.* (*Hospital Records*, 1906-1907, vii, p. 833.)

Isidor L., age thirty-eight, tailor, Russian. Admitted July 24, 1906. Since three years terminal pain at micturition, frequent nocturnal voiding. Condition much aggravated during past four

months, since when urine has become very turbid and bloody at end of voiding. On admission, no signs of pulmonary tuberculosis. Pulse and temperature normal. Urine loaded with pus and red blood-cells. No tubercle bacilli. In the right loin a small, very tender hard mass could just be made out. Right kidney not palpable. Cystoscopy: congestion of trigonum; right ureteral opening closed by blood-clot. July 30, explorative nephrotomy of left side, with negative result. August 31, nephrectomy of right kidney, which was found the seat of miliary tubercles and contained a number of small abscesses. No stones. Individual ligation of vessels. Convalescence retarded by the formation of several abscesses in both wounds and in the perineum, all of which were drained. December 26, discharged much improved, with clear urine but frequent urination.

CASE LXXII.—*Tuberculosis of right kidney. Nephrectomy and ureterectomy. Exploratory cystotomy. Secondary cystorrhaphy. Improvement.* (*Hospital Records*, 1906-1907, vii, p. 839.)

Justine R., age forty-three, housewife, Hungarian. Admitted January 14, 1907. Father died of tuberculosis. Three months ago acute pain in right loin, with chill and vomiting, followed by frequent and painful urination. Pain radiating to bladder. On admission, fairly well nourished, heart and lungs normal. In right loin a smooth, movable, and painful tumor of the size of an orange. Cystoscopy. Base of bladder intensely congested, hemorrhagic spots in trigonum. Orifice of right ureter œdematous, congested. Urine from this side: much pus, blood. Catheter met with obstruction 3 cm. up. Left side, urine normal. Radiographic plate showed shadow in right ureter corresponding to obstruction. January 22, nephrectomy, cystotomy, exploration of right ureter. Easy delivery of kidney, in which several abscesses were recognized. Individual ligation of vessels. Ureter was exposed down to the bladder, no stone could be felt. Cystotomy. Ureteral aperture divulged and ureter explored. No stone found. Suture of bladder. Ureter excised. Kidney was peppered with miliary tubercle and contained several abscesses, one containing one ounce of grumous pus. Permanent catheter in bladder. Convalescence much delayed by prolonged burrowing suppuration around the stump of kidney, and by a late breakdown of the healed bladder scar, needing secondary cystor-

rhaphy. October 9, discharged with closed lumbar wound, that of the bladder showing occasional minute leakage. General condition excellent. Urination still frequent, but not painful.

CASE LXXIII.—*Tuberculosis of right kidney. Nephrectomy. Cure.* (*Hospital Records*, 1907-1908, viii, p. 951.)

Valeria H., age thirty-five, housewife, German. Admitted February 10, 1908. Operated on eleven years ago for appendicitis. Three months ago began to feel burning pain in vulva before and after voiding, with increased frequency of urination, and noticed sharp, intermittent pain in right loin. Has been in bed three months. In January operation for cysto-retrocele in gynæcological department, from which she was transferred to us. On admission, no pulmonary signs; positive Calmette. In right loin a large, tender, movable mass. Temperature 99° F., pulse 84. Cystoscopy. Multiple ulcers of bladder mucosa in trigone. Urine: right side, very turbid, alkaline, loaded with pus, no tubercle bacilli; left side, alkaline, trace of albumin, no pus, red blood-corpuscles. Combined urine, cloudy, acid, 1024, much pus, few red blood-corpuscles. Radiograph, faint shadow in right kidney. February 13, nephrectomy. Vessels tied separately. Ureter much congested and brittle. Pathological report of specimen, tuberculosis of kidney. April 1, discharged cured.

CASE LXXIV.—*Tuberculosis of left kidney. Nephrectomy. Ureterectomy. Cure.* (*Hospital Records*, 1907-1908, viii, p. 953.)

Frida F., age twenty-two, clerk, Russian. Admitted April 29, 1908. Since four months, frequent and painful urination, fever and chilliness at night. Night sweats. Dry cough; loss of flesh and strength. On admission, long, flat chest, distinct retractions at apices, with dulness on percussion; no tubercle bacilli in sputa. In left loin a distinct tender mass. Temperature 104° F., pulse 120. Cystoscopy report, lost. Urine clear, acid, 1010, much pus. April 30, nephrectomy. Kidney much enlarged. In upper pole a large abscess, its evacuation facilitated delivery. Ureter much thickened; was severed. Elastic ligature and ablation. Ureter stripped off the peritoneum for six inches. Second incision parallel to Poupart's ligament and retroperitoneal exposure of lower part of ureter. Isolation and ablation near bladder. A dense band of connective tissue tied down ureter at crossing with

external iliac. Specimen: kidney twice the size of the normal, studded with numerous miliary tubercles. Abscess cavity in upper pole lined with cheesy, necrotic material. Ureter much thickened and dilated. Ligature came away on thirty-sixth day. Uneventful recovery. June 7, discharged cured, with much improved general condition. Urination painless, six times in 24 hours. Urine clear, acid, still containing a few white blood-corpuscles.

CASE LXXV.—*Tuberculosis of right kidney, ureter and bladder. Nephrectomy and ureterectomy. Death from general miliary tuberculosis. (Hospital Records, 1907-1908, viii, p. 955.)*

Chawe B., age twenty-eight, housewife, Russian. Admitted November 13, 1907. No pulmonary history. One year ago began to get paroxysmal attacks of pain in both loins, oftener and more severe on right side. Frequent and painful voiding. Since eight months turbid urine, with constant suprapubic pain. Four months ago suprapubic cystotomy in a Brooklyn hospital. Wound healed in three months, but reopened. Chills and fever set in after this operation. Cough and profuse expectoration since one month. On admission, emaciated; narrow chest; retraction above clavicles; no gross signs of lung trouble except bronchitis. Left kidney non-palpable. In right loin distinct, tender, moderately movable mass. Suprapubic urinary fistula. Cystoscopy. Intense cystitis, ureteral orifices could not be found. Temperature 102° F.; pulse 120, weak. Urine amber, turbid, acid, 1016, loaded with pus. Hyaline and granular casts. The radiograph shows a small stone in left kidney. November 19, nephrectomy of right side. Elastic ligature inside of fibrous capsule. Specimen: large kidney with thinned cortex and filled with foul pus. Several discrete cortical abscesses. Ligature came away on eighteenth day. Wound healed except in lower angle, where probe entered ureter and could be pushed into bladder. Bladder still very irritable, but general condition had improved with lowering of temperature. Suprapubic fistula still discharging. May 5, ureterectomy. Loosening of upper end of ureter, then, by iliac incision, retroperitoneal exposure of lower end of ureter, and excision at crossing with uterine artery. May 15, increased pulmonary trouble, cavities can be demonstrated. Laryngeal tuberculosis. Continued hectic fever. July 4, died of exhaustion.

Post Mortem.—Miliary tuberculosis of left lung. Right lung, miliary tuberculosis and several somewhat large cavities lined

with necrotic material. Laryngeal tuberculosis. Left kidney enlarged, miliary tuberculosis; in cortex a number of abscesses, some communicating with pelvis, which contained a small stone. Bladder, mucosa studded with innumerable miliary tubercles; no ulcers. At ileocæcal valve large circular ulcer.

CASE LXXVI.—*Tuberculosis of left kidney. Nephrectomy. Cure.* (*Hospital Records*, 1910-1911, ii, p. 1296.)

Rosie G., age thirty-seven, button-hole worker. Austrian. Admitted June 29, 1911. Had pneumonia and pleurisy six months ago; since then has not recovered health. Since three months swelling of legs, night sweats, and frequency of urination. On admission, systolic murmur over apex, and accentuated second pulmonary sound. In left loin a large, hard, immovable and tender tumor. Temperature 99°, pulse 100. Urine, pale amber, cloudy, alkaline, 1008, albumin, no sugar, pus, a few red blood-corpuscles. July 20, extracapsular nephrectomy. Individual ligature of vessels. Pathological report, tuberculosis. Uneventful recovery. Discharged cured, August 6, 1911.

CASE LXXVII.—*Tuberculosis of left kidney. Nephrectomy. Cure.* (*Hospital Records*, 1910-1911, p. 1300.)

Boleslaw B., age thirty-eight, hatter, Russian. Admitted October 25, 1911. Four years ago affection of right lung with cough, fever, and night sweats, which trouble lasted one year. Two and a half years ago onset of paroxysmal attacks of pain in left loin, radiating to genitals. Urine bloody off and on. Fever and chills, and emaciation. On admission, temperature 100° F., pulse 80. Urine amber, cloudy, acid, tubercle bacilli present. Lungs normal. In left loin, a tender, fixed mass the size of a small fist. Cystoscopy: Catheterization of right ureter. Urea 2 per cent. Left ureter not catheterized. Radiograph negative. October 30, 1911, extracapsular nephrectomy. Individual ligature of vessels. Specimen: organ moderately enlarged. A large tuberculous focus in lower pole, which had not perforated into calix of pelvis. Uneventful recovery. Discharged cured, November 15, 1911.

CASE LXXVIII.—*Tubercular pyonephrosis. Nephrotomy. Nephrectomy. Cure.* (*Hospital Reports*, 1903, p. 161.)

Mary H., age twenty-four, music teacher, single. When nine years old suffered from "spinal trouble," for which she wore jury mast during six months. Preceding this had a discharging

ear. No cough, no night sweats. Three years ago commenced to complain of frequent and painful urination. Had to empty bladder every two hours. Eighteen months ago blood appeared in urine; sometimes it was fresh, at other times clotted. A physician cystoscoped her, and found an ulcer of the bladder. A week ago noticed dull pain in right lumbar region, radiating to shoulder-blade, then had severe attack of renal colic. On admission, December 6, fair condition. Heart, lungs, liver, and spleen normal. In right hypochondrium a large mass, slightly movable, tender to touch; no respiratory movement. Temperature and pulse normal. Urine acid, 1024, 1 per cent. of albumin (Esbach), with sediment of half an inch of pure pus in the test tube; urea 2.2 per cent. Amount of urine, 45 ounces. Urinated every hour. December 8, cystoscopy. Bladder trabeculated; mucosa normal, except in trigonum, where it was intensely congested. During inspection a jet of clear urine was emitted by left ureter. In spite of deep anæsthesia bladder intolerant, holding 3 ounces with difficulty. December 10, nephrotomy, ether. On account of the poor pulse, intravenous saline infusion of 1000 c.c. Aspiration withdrew pus. Reflection of peritoneum was incised, and the hand was passed in to ascertain presence of the left kidney, which was found normal in size and consistence. Peritoneum closed. Kidney showed two fluctuating areas; these were incised and grumous contents evacuated. Patient's condition beginning to fail, kidney was replaced and outer wound packed; nephrectomy postponed to another occasion. Operation followed by severe chill, which might have been due to saline infusion. Irritability of bladder markedly diminished. Discharge from kidney continuing profuse, nephrectomy was done December 31. Development of kidney easy; pedicle secured by rubber ligature. January 3, 1901, urine clear, acid, of sufficient quantity. January 18, patient out of bed. January 20, ligature came away. Irritability of bladder much improved. February 8, discharged cured.

CASE LXXIX.—*Tubercular pyonephrosis. Nephrotomy. Nephrectomy. Cure.* (*Hospital Reports*, 1903, p. 163.)

Jacob E., tailor. Eight months ago had "attack of gravel," with pain in groin and penis; turbid urine; no hæmaturia. For past four months constant abdominal pain of varying severity; attacks more severe at night. Had lost 30 pounds. On

admission, April 18, condition poor and anæmic; temperature 102.6°. Retraction above and below both clavicles. Crepitant râles in both lungs. Heart, liver, and spleen normal. Right rectus rigid. A small reducible ventral hernia one and one-half inches below xyphoid. Bimanual palpation of right hypochondrium and loin painful, and on account of muscular rigidity unsatisfactory. Rectal palpation showed hard, painless nodule occupying median portion of prostate. Urine cloudy, acid, 1022; traces of albumin; copious sediment containing only pus-cells; daily amount, above 30 ounces. April 22, examination under chloroform. Large, nodular mass in right flank, colon displaced forward. Puncture yielded pus. Cystoscopy. Right ureteral orifice dusky and congested; left ureteral orifice normal. April 26, nephrotomy and drainage; ether. Kidney was opened along convexity; a system of abscess cavities evacuated. Intervening septa were broken down; one of these bled profusely; as brittle parenchyma would not hold a ligature, clamp left *in situ*; drainage, wound partly closed and dressed. Considerable post-operative reaction, temperature rising to 104° F. April 27, profuse discharge of bloody serum. April 29, clamp removed, packings changed. Discharge gradually became purulent, and continued very profuse. May 27, nephrectomy. Incision in old scar. Granulating sinus excised down to kidney. Difficult isolation and development of shrunken kidney, during which a number of small abscesses were ruptured. While applying elastic ligature to pedicle, the latter was torn. By a lucky pass retracted pedicle secured, clamped, withdrawn, and tied with double silk ligature passed with Deschamps needle. May 28, moderate febrile reaction. Ligatures cast off July 11. July 28, discharged cured. Urine clear.

CASE LXXX.—*Tuberculosis of left kidney. Nephrotomy. Nephrectomy. Cure.* (*Hospital Records*, 1907-1908, viii, p. 952.)

Edmund P., age twenty-seven, German, machinist. Admitted December 11, 1907. Gonorrhœa six years ago. Three years ago burning pain on frequent voiding. Six months ago pain with noticeable swelling was felt in left loin; urine became turbid, frequency of urination increased. During numerous attacks of colic had chills and passed bloody urine. Night sweats. Lost eight pounds of flesh. On admission, emaciated; temperature

101° F., pulse 104. Lungs negative. Kidneys non-palpable. Urine amber, turbid, acid, 1022, loaded with pus, no tubercle bacilli. December 16, temperature 105° F. Three attempts at cystoscopy failed on account of intolerance of bladder. January 13, cystoscopy in anaesthesia. Posterior bladder wall covered with ulcers, free hemorrhage frustrated catheterization of ureter. Radiography negative. The continued fever, the irritability of the bladder and the pain in right loin determined nephrotomy on January 25. Kidney imbedded in dense cicatricial mass; much enlarged; protruding fluctuating areas yielded grumous bloody detritus. Transcortical drainage of pelvis. January 26, tubercle bacilli found in discharge from drainage tube. February 6, subcapsular nephrectomy. On account of dense adhesions and shortness of pedicle, some parenchyma left adhering to stump to prevent slipping of ligature. As several abscesses had opened during the delivery and had soiled wound, this was packed and not sutured. February 15, little reaction followed operation. Urine much clearer. Secondary suture of wound. February 27, ligature came away. March 5, urine clear, amber, acid, 1016, no pus nor blood. Discharged cured, with small granulating wound.

Note.—This series contains only 18 of our 20 histories of tuberculosis of the kidney. The two other cases will be found on pages 8 and 12.

ECHINOCOCCUS.

Of the two instances of echinococcus successfully treated by nephrectomy, one presents no unusual features; the other, however, is full of surgical interest. Renal hydatids are a very rare affection; the left kidney is attacked twice as often as the right one. Calcification of the hydatid sac is of the utmost rarity. Our second case belongs to this class.

CASE LXXXI.—*Echinococcus of left kidney. Nephrectomy. Cure.* (*Hospital Records*, 1910-1911, p. 1298.)

Charles K., age forty-one, Russian, peddler. Admitted September 5, 1911. Since ten years had many attacks of "gravel," passing calculous grit with bloody urine and acute pain in left loin, bladder, and urethra. During renal attacks had fever and chills. On admission, temperature 99° F., pulse 96.

Urine amber, clear, acid, 1020. No albumin or sugar. No blood, oxalates, or urates. In left loin a large, balloting, kidney-shaped, tender mass, the size of a grape-fruit. Radiograph, no evidence of calculus. September 8, nephrectomy. Oblique incision; exposure of peritoneal reflection. Spleen could be clearly distinguished from tumor. Descending colon stripped off from anterior surface of tumor, exposure and individual ligation of vessels. Separation of a large number of adhesions between fatty and fibrous capsules. Specimen: shape of elongated gourd, one end much thicker than the other. Pelvis much distended. On section only a narrow zone of parenchyma left; renal sac and pelvis filled with many mother and daughter cysts; scanty fluid contained hooklets. Uneventful recovery. Discharged cured, October 1, 1911.

CASE LXXXII.—*Echinococcus of the right kidney. Complete calcification of the entire sac. Excision of a fenestrum of the sac and evacuation of cystic contents. Secondary resection of portion of kidney and extirpation of concremental shell. Cure.* (Contribution, etc., *loc. cit.*, p. 684.) (From German Hospital, New York.)

Mrs. E. D., age twenty-six years, was presented by Dr. Steudel, of Seymour, Conn., June 19, 1895. The delicately built, small woman was pregnant in the sixth month, and stated that up to within three months she had felt entirely well, with the exception of a dull and heavy feeling which had existed in the right hypochondrium for about seven years, but had caused no serious inconvenience. Eight years ago, while serving in a place in Germany, she had regularly to feed a number of dogs. A fortnight ago was attacked by severe renal colic while voiding urine, and observed that toward the end of micturition a number of grape-like bodies passed. A collection of these bodies was shown to me. I immediately recognized them as secondary hydatids. Dr. Steudel also found a considerable tumor in the right loin. This was found to be smooth, unusually resistant, non-fluctuating, and immovable. It extended downward in the right hypochondrium to the level of the navel, but was not influenced by respiratory movements. Corresponding to the lowermost portion of the mass, a smaller, knob-like, softish projection could be felt; this was very tender on pressure. By percussion it could be ascertained that the tumor extended up-

ward posteriorly to the level of the seventh rib. Moderate nightly elevations of the temperature. On admission daily quantity of urine was 1430 grammes. It contained neither albumin, pus, nor sugar. All other organs were normal. On June 21, under chloroform anæsthesia, tumor was exposed by oblique lumbar incision. It became evident that the knob-like projection found on the lower circumference of the mass consisted of about two-thirds of the normal kidney, upon the upper pole of which, and connected with it, rested the large ovoid tumor, having the shape and size of a small cocoanut. An attempt to puncture the tumor failed. The stout needle used could not be forced into it, breaking off. Finally, with considerable trouble, a square aperture was cut into the bony investment of the tumor by means of a stout resection-knife. Beside a small quantity of turbid serum, the cavity contained nothing but a closely packed, nested mass of hydatid membranes, enclosed in a large outer membrane. All this material was scraped out with a sharp spoon; it was then seen that the rough, bone-like shell was bleeding wherever scraped, hence it became clear that it was organized. The oozing was so considerable that it was necessary to plug the cavity and to dress the wound. It may be added that the sharp spoon everywhere encountered the same resistance that an osseous cavity would offer. The place of communication between the hydatid cyst and the pelvis of the kidney could not be found.

Operation was borne very well; but in the course of the next week it became more and more evident that the cavity had not the slightest tendency to collapse and to diminish. It was evident that as long as the hard shell remained, closure of the wound could not be expected. In Simon's case a number of small, bony plates were expelled, having apparently sloughed away. In this case, however, we had not a rudimentary formation of small detached osseous plates, but a complete, bone-like capsule of extremely hard material, which, as seen later on, varied in thickness from between one-fourth to one-half of an inch, and was everywhere vascularized. Hence it was not probable that spontaneous expulsion would occur. As the outer sac of echinococcus cysts enters into intimate connections with all the organs of the vicinity, extirpation of the sac is rightly considered one of the most difficult undertakings. It was condemned by Simon as improper and inadmissible. In spite of these considera-

tions the contingencies of the case seemed urgently to point to the necessity of extirpation, which, with the consent of the patient, I determined to carry out.

On July 15, she was accordingly chloroformed. Operation was exceedingly difficult, troublesome, and laborious, both on account of the deep and inaccessible situation of a large part of the osteoid sac, and on account of the serious complications which had to be encountered in the shape of the invasion of both the pleural cavity and the peritoneum. Two of the lower ribs were excised, and even then the removal of the closely adherent calcareous masses was very difficult. Blunt dissection was inapplicable. The edge of the knife had to be used throughout. When the pleural cavity was widely opened, alarming cyanosis and heart failure set in. The pleural defect was quickly plugged, and artificial respiration instituted. After about five minutes the patient's condition improved so far that the operation could be continued. Just as on the pleural side, so toward the peritoneum the sac had incorporated the serous membrane, and a large portion of the peritoneum had to be taken away. As soon as the mass was detached from the peritoneum the defect was closed with a catgut suture. The irregular-shaped, calcareous shells composing the entire capsule were of different sizes, the largest one measuring over 7 cm. in both directions; however, most of them were much smaller and were connected along irregular lines by short and dense connective tissue, resembling the lines of cranial sutures in an infant's skull. Finally, after about two hours' hard work, all the calcareous masses were removed. The wound was packed and the patient brought to bed. Considerable collapse followed, recurring from time to time unexpectedly, so that considerable vigilance had to be exercised. Finally, on the third day, the pulse became steadier and the patient's face lost its pinched look. On July 19, the packings were removed from the main cavity, which had contracted very considerably. The pleural packings were removed on July 21, and from this date, progress was steady and rapid until the middle of August, when the patient aborted, but this did not retard recovery. The general condition steadily improved, and the large cavity contracted, so that the patient could be discharged cured, August 22. Professor Simon explicitly mentions that in his case (No. 6) the extruded plate-like mass contained osseous tissue. In this instance the pathologist found

calcareous matter only. The remarkable collection of potsherd-like concretions vividly recalled the shape of infantile cranial bones. The patient became perfectly well. On palpation the remnant of the kidney could be felt connected with a resistant mass resting above it, which undoubtedly consisted of shrunken cicatricial tissue.

POLYCYSTIC DISEASE.

The difficulty of recognizing this malady was again emphasized by the following case:

CASE LXXXIII.—*Polycystic left kidney. Nephrectomy. Cure. (Hospital Records, 1910-1911, p. 1301.)*

Sarah P., age twenty-seven, Russian, finisher. Admitted December 30, 1910. Six days ago began to feel acute pain in left loin, with vomiting. No radiation. Urination normal. On admission, healthy looking woman. In left loin a mass, of which only the lower pole can be felt. It moved with respiration, was not tender to touch; inflated colon masked it. Temperature 100° F., pulse, 100. Urine amber, clear, acid, 1019; no albumin or sugar; no blood; pus-cells and occasional hyaline casts. Cystoscopy. Left kidney, urea 0.3 per cent.; right kidney, urea 2 per cent. Radiograph: no calculus. January 5, 1911, nephrectomy. Individual ligatures. Kidney 8 x 5 x 3 inches, in state of polycystic degeneration. Uneventful recovery. Discharged cured January 24, 1911, with sufficient function of remaining kidney.

HYDRONEPHROSIS.

CASE LXXXIV.—*Hydronephrotic floating kidney of left side from flexion of ureter. Nephrectomy. Cure. (Contribution, loc cit., p. 680.)* Example of Fenger's "sacculated cystonephrosis."

Mrs. T. R., age twenty-five. Admitted December 2, 1896. Patient declined risks of conservative measures. December 4, nephrectomy. Individual ligatures. Discharged cured, December 24.

The futility of ureteroplasty in the presence of infection of the hydronephrotic sac is illustrated by the following two cases:

CASE LXXXV.—*Chronic ascending pyelitis of left side. Hydronephrosis from stricture of renal orifice of ureter. Nephrotomy. Ureteroplasty. Renal fistula. Nephrectomy. Cure. (Hospital Reports, 1899, p. 210.)*

Harry G., age twenty-nine. Admitted January 6, 1898. Repeated gonorrhœal infection with cystitis. Last December violent renal colic of left side with temperature 105° F. Urine loaded with pus. January 7, nephrotomy. Kidney much distended by large quantity of ammoniacal seropurulent fluid. Lining intensely congested. Drainage. Profuse secretion of sinus. Urine voided by urethra 40 ounces per 24 hours, 1024, free from pus or blood. Evidently the left ureter was blocked. March 18, ureteroplasty. Pelvic orifice of ureter surrounded by an ulcer; the stricture permitting the passage of a fine silver probe only. Ureter severed below stricture, stump inverted and sutured from outside of pelvis. Implantation of distal part of ureter into most dependent part of sac. April 23, profuse urinary discharge from pelvic sinus, denoting closure of plastic stoma. Continued catheterization through external wound futile. Intense pyelitis. July 1, nephrectomy. August 2, discharged cured.

CASE LXXXVI.—*Periodical hydronephrosis of right side. Atrophic ureter. Ureteroplasty. Nephrectomy. Incision of peri-ureteral abscess. Death. (Hospital Reports, 1901, p. 333.)*

Isidor B., twenty-nine years old, knitter. Sixteen months ago began to complain of severe pains in the right loin, which returned from time to time in the form of acute paroxysms lasting several days, to disappear as suddenly as they had come. No fever or vomiting during these attacks; never had been jaundiced. Attacks getting more and more frequent, occurring lately every four weeks. No blood in urine, nor painful or frequent urination, nor increase in amount of water at the conclusion of attacks, but now there was constant pain and fulness in right loin. Lost ten pounds in weight. On admission, January 5, 1900, thin, small, and emaciated. Marked retraction above both clavicles, dulness over right apex; lungs otherwise normal; heart, liver, spleen

normal; abdomen soft, moderately distended. Right loin: a tender, tense tumor, no fluctuation. Urine normal in every way. Respiration, pulse, and temperature normal. Daily quantity of urine varying between 24 and 40 ounces. January 15, ureteroplasty. Ether. Usual oblique incision; kidney exposed and developed. Was a slender and long organ. Pelvis baggy, dilated. Ureter exceedingly slender, almost infantile in size. Pelvis incised for the distance of an inch near ureter; orifice found with much difficulty; it was so small that a fine silver probe could be passed through only after much coaxing. The pelvic incision was continued down through the orifice of the ureter for one-third of an inch, this longitudinal wound being transversely united by three fine catgut sutures according to Fenger's procedure. Drain to the plastic suture. Extremely small dimensions of ureter rendered suture very difficult, and made success so doubtful that the idea was considered whether it would not be wiser to remove the kidney at once. Patient did very well after operation, temperature remaining normal, bowels moving without difficulty, sufficient quantities of normal urine being voided *per urethram*. Dressings changed daily; showed no signs of leakage up to January 19, when they were found soaked with urine. Directly after this soiling of the wound, fever set in, rising occasionally as high as 103° . January 21, external sutures removed, and outlet given to pus which had collected around upper part of the ureter. After this fever disappeared, but patient began to complain of painful and frequent urination, the urine containing pus and hyaline casts, and as most of the urine secreted by the right kidney escaped through wound, the fear seemed justified that the other kidney was diseased. January 28, milk injected into pelvis of right kidney. No traces of this appeared in water voided from the bladder. February 15, nephrectomy. Development of the strongly adherent kidney was difficult. It possessed two pelves and two ureters, the ureter coming from upper portion of kidney inosculating in the lower, much-dilated pelvis, upon which the plastic operation had been done. Ureteral orifice was completely obliterated, pelvic portion of incision patulous. Kidney was enlarged, congested, both pelves hyperæmic. Vessels and ureters separately tied, kidney removed, wound drained. Patient rallied slowly and imperfectly; energetic stimulation. February 21, temperature normal, 32 ounces

of alkaline urine, albumin, pus, no casts, oxalate of lime crystals. Wound doing well. March 1, patient much better, left the bed. Urine, 32 ounces, acid, 1020, no albumin, very few pus-cells, daily quantity 33 to 40 ounces. March 14, had gained 12 pounds in weight; wound nearly closed, there only a narrow sinus discharging a little seropus remaining. At own request patient was discharged, to be dressed by his family physician.

Readmitted April 20. General condition extremely poor. Patient profoundly septic, had high fever, vomiting; wound evidently septic, discharging large quantities of ichorous pus; pulse very feeble and frequent. Resistant, painful tumor, extending from loin downward toward ramus pubis; integument oedematous. Pressure over this swelling caused large quantities of pus to flow out of wound. Urine very turbid, scanty, 1008, albumin, much pus, no casts. April 21, chloroform. Scar re-opened and incision carried well below anterior superior spine, through abdominal muscles into retroperitoneal abscess. There was then no visible communication with the peritoneal cavity. Operation lasted only ten minutes, but caused extreme exhaustion; persistent vomiting. Temperature remained high, never descending below 103° F.; pulse became constantly weaker and more rapid. Urine more turbid and scanty. Died on April 24, under the symptoms of septic peritonitis and nephritis. Autopsy: open communication of wound with right side of the pelvis, the seat of purulent peritonitis. Adjoining colon and a portion of omentum limited the site of peritoneal infection. More distant coils slightly injected; free serous exudate in the unaffected part of peritoneal cavity. Spleen slightly enlarged, soft, Malpighian bodies prominent. Liver congested and degenerated. Left kidney large, capsule slightly adherent; congested, granular and degenerated; pelvis contained one calculus; ureter normal.

Epicrisis.—A virulent infection of the wound had evidently occurred after patient's discharge from hospital. It had descended downward along the course of ureter and had involved the peritoneum overlying the infected space. This infection also rekindled the nephritis of the remaining kidney, handicapped by the presence of a renal calculus. In the light

of the issue, it would have been wise to remove the right kidney primarily.

CASE LXXXVII.—*Left hydronephrosis. Calculus. Atrophy of right kidney. Uræmia. Left nephrotomy. Right nephrectomy. Death.* (*Hospital Reports*, 1905, p. 167.)

Fanny I., age twenty-six. Admitted September 5, 1903. Forty-eight hours before was suddenly taken with agonizing pain in left lumbar region. Passed no urine within last 24 hours, nor did catheter draw any urine. On admission, internal organs normal. Rigidity of left half of abdominal wall. A smooth, rounded, tender mass in left hypochondriac and lumbar regions. Bladder empty. General condition bad; anxious face. Pulse 110, good; temperature 99°. Immediate nephrotomy of left side. Renal pelvis dilated, contained stones. Parenchyma thinned. Stones removed. Drainage. Reacted well, but general condition and pulse deteriorated, while secretion of urine, comprising 13 ounces on September 6, amounted to seven ounces on September 7, while on September 9 there was complete anuria. Increasing uræmia. September 9, right kidney exposed. After considerable search a small, round, soft mass, about two inches long and one inch wide, and connected with the ureter, was identified as the remnant of right kidney. This was extirpated. Uræmia was relieved, sufficient quantities of urine escaping through both external wounds and were withdrawn by catheter. Unfortunately, both wounds became infected, extensive necrosis of the tissues followed and sepsis led to the death of patient on September 22.

CASE LXXXVIII.—*Hydronephrosis. Nephrectomy. Cure.* (*Hospital Reports*, 1905, p. 170.)

Betsie K., age nineteen. Admitted November 2, 1903. Present illness, similar to another attack six months ago, was of two weeks' duration. Had pain in right side and back, chilly feelings and nausea. On admission, general condition good, internal organs normal. In right flank large, movable, smooth, tender mass. Urine contained a faint trace of albumin, was otherwise normal. Temperature and pulse normal. November 6, 1903, exploration revealed enormously distended kidney and pelvis, there was hardly any trace of parenchyma. Removal

of the organ. Uninterrupted recovery. December 12, discharged cured.

CASE LXXXIX.—*Hydronephrosis of right kidney with congenitally narrow ureter. Nephrectomy. Cure. (Hospital Reports, 1905, p. 170.)*

Sarah S., age twenty-five. Admitted March 30, 1904. Illness of two to three years' duration, with weekly attacks of headache, nausea, and constipation. On admission, general condition good, internal organs normal, right kidney palpable. Temperature 103°, pulse 120. Urine normal. April 2, exploration revealed enlarged kidney; pelvis much distended, ureter exceedingly small, cortex very thin, here and there cystic. As smallness of ureter precluded any plastic measure, kidney was removed. Uninterrupted recovery. April 26, discharged cured.

CASE XC.—*Hydronephrosis of right side. Pyelonephritis. Nephrotomy. Nephrectomy. Cure. (Hospital Records, 1898, ii, p. 794, and 1899, i, p. 487.)*

Mary L., age fifty, Russian. Admitted November 1, 1898. Ten children. Fifteen years ago sharp attack of pain in right side. Since then more and more frequently recurring attacks; nine attacks of renal colic in the last three months. Cloudy urine, frequent voiding, loss of flesh and strength. Right kidney palpably enlarged and painful. Urine 1024, acid, turbid, albumin, no sugar, much pus. Cystoscopy: moderate cystitis. Declined puncture. November 17, discharged. January 1, 1899, readmitted. Since discharge had had several attacks of colic with chills, high fever, and sweating. Temperature 98.6°. Swelling in right lumbar region much increased. January 13, cystoscopy. Left ureter normal. Orifice of right ureter congested; escape of turbid urine observed. January 17, nephrotomy. Incision liberated large quantity of turbid urine. Drainage to reduce size of tumor. February 17, typical nephrectomy, separate ligation of vessels. Ureter found much dilated; sewed into wound for drainage. March 20, ureter dry, inverted, and buried. March 26, discharged cured.

CASE XCI.—*Congenital subcapsular hydronephrosis. Nephrectomy. Death. (Hospital Records, 1906-1907, vol. vii, p. 822.)*

Isidor G., nine months old. Admitted September 23, 1907. Was born apparently healthy. Two months ago had severe

attack of high fever, lasting twelve days. Since then continuous evening fever. For two weeks much straining both at defecation and urination, the latter being very frequent. Lately mother noticed swelling in right loin. On admission, in right side of abdomen a mass extending from costal border to Poupart's ligament, and inward to median line. Abdominal muscles not rigid, mass not tender, not fluctuating. Per rectum mass could be felt two inches above sphincter. Aspiration drew a clear fluid, reaction neutral, color amber, containing urea and pus-cells. October 1, 1907, nephrectomy. Exposed tumor was evacuated by trocar puncture. In liberating the ventral aspect of the mass, a fluctuating, thin-walled sac was exposed, from which the ureter was seen emerging. This sac was closely adherent to the main mass, being evidently the distended pelvis. After ligation of vessels, the tumor was removed. Examination of specimen demonstrated the presence of a subcapsular hydronephrosis. A patulous defect of the parenchyma communicated with a large space between cortex and capsule proper. The capsule had become separated from the kidney, except where it was attached externally to the pelvis. Ureter congenitally small, its calibre not more than 1 mm. in diameter. Patient died two hours after operation in profound shock.

CASE XCII.—*Pyonephrosis of right side from infected hydronephrosis. Nephrotomy. Secondary nephrectomy. Temporary cure.*¹ (*Hospital Records*, 1907-1908, p. 947.)

Louis N., age fourteen, schoolboy, United States. Admitted September 14, 1907. Three years ago was operated on at Vienna for spina bifida. Incontinence of urine since birth. For past four weeks had been in another hospital, where instrumental examination of bladder was done under anæsthesia. Directly afterward high fever (103° F.) set in, whereupon he was transferred to Mt. Sinai Hospital. On admission, complained of sharp pain in right loin, where a mass, the size of a large apple and very tender, could be palpated. Temperature 104° F., pulse 118. Urine amber, turbid, alkaline, 1008, loaded with pus. September 19, right nephrotomy and drainage. Cortex studded with a number of small abscesses. Pelvis dilated and filled with pus; parenchyma pale, very scanty. Cystoscopy being impossible on account of incontinent bladder, on December 19 left kidney was

¹ June, 1908, readmitted with uræmia; died 18 hours after admission.

exposed and found to be of normal size and shape. December 26, right nephrectomy. Large, lobulated kidney with congested, flabby pelvis. January 30, ligature came away. February 4, 1908, discharged improved, with healed wound. Urine amber, clear, 1012, no pus-corpuscles, granular casts. Had gained considerable flesh; incontinence unchanged.

CASE XCIII.—*Calculous hydronephrosis of left side. Nephrectomy. Cure.* (*Hospital Records*, 1909-1910, x, p. 1471.)

Herman G., age twenty-nine, paper cutter, United States. Admitted, July 3, 1910. Sudden onset of hæmaturia two months ago, persisting ever since. Very profuse while patient was up and about; moderate while recumbent. Urinated every three hours. No pain of any kind; no fever or chills; no vomiting, but had lost twelve pounds in weight. On admission, marked anæmia, hæmoglobin 39 per cent. Large mass in left loin, not tender, fluctuating and very movable. Temperature 100° F., pulse 84. Urine red, turbid, neutral, full of red blood-cells, no casts. Urea $4\frac{1}{2}$ grains to ounce. Cystoscopy: bladder and ureteral orifices normal. Left ureter, discharging bloody urine, alkaline, urea 0.7 per cent.; right ureter, amber, clear, acid, urea 3 per cent. Radiograph: two shadows in left kidney. July 7, exposure of left kidney by oblique incision. Puncture withdrew large quantity of bloody urinous liquid. Easy delivery. Individual ligature of vessels and ablation. Uninterrupted recovery. July 20, discharged cured.

Pathological Report.—Hydronephrosis, two pelvic stones. A small area of parenchyma left near lower pole.

Causes of death: (1) Uræmia (patient admitted with this condition); (2) secondary infection of sinus and peritonitis; (3) operative shock (patient an infant).

NEOPLASMS.

Statistics.

| | Cases. | Deaths. |
|----------------------|--------|---------|
| Cystic adenoma | 1 | 1 |
| Sarcoma | 7 | 2 |
| Hypernephroma | 7 | 4 |
| Carcinoma | 3 | 1 |
| | — | — |
| Totals | 18 | 8 |

Mortality 44.4 per cent.

Causes of death: operative shock, 2; peritonitis, 1 (transperitoneal nephrectomy for hypernephroma); pneumonia, 1 (epileptic patient); relapse, 4; total, 8.

The discouraging figures of our table show that nearly one-half of the patients operated upon for neoplasms have died. One-half (4) of the deaths followed directly after operation, and these must be attributed either to traumatism or to infection caused by the interference. The other half of the deaths (4) were due to a more or less rapid return of the disease itself. Furthermore, as the histories of the patients discharged as "cured" were not followed, there is no proof whatever of the permanency of their cures. On the contrary it may be assumed that relapses have also occurred among these.

The correctness of the diagnosis of "sarcoma" in some of the cases of older date may properly be questioned. Probably some of these would be classed to-day as hypernephroma.

The following case may serve as a good example illustrating the value of those principles of technic that were described in the first part of this essay, whenever the surgeon has to deal with a large and solid renal tumor.

CASE XCIV.—*Adenosarcoma of right kidney. Nephrectomy. Cure. Relapse. Death.* (*Hospital Records*, 1896, ii, p. 98.)

Dora G., age five and a half years, United States. Admitted June 13, 1896. Complained for six weeks of pain in right loin. The parents discovered a rapidly growing swelling there. No fever, no urgent or frequent urination. Lost flesh and strength. On admission, a well-grown child, emaciated and anæmic. Subcutaneous veins of right flank and abdomen much distended. In right loin a somewhat movable, ovoid, semifluctuating, smooth tumor, extending from diaphragm downward to below anterior superior spine, and inward to median line of belly. Temperature 99.4°, pulse 96. Urine clear, amber, acid, 1020; no albumin, blood, or pus. Inflated colon did not traverse median line; it was all situated in left half of belly. June 22, nephrectomy. Incision from margin of erector spinæ, running obliquely forward four inches beyond median line, practically bisecting the trunk. Intestines were gathered into a large, wet

and hot napkin and securely held by an assistant. The posterior parietal peritoneum was intimately adherent to anterior aspect of the friable tumor; the cæcum and transverse colon were displaced far downward and toward the left side. The stripping of the peritoneum from the anterior aspect of the tumor was attempted but given up on account of the certainty of rupturing into the tumor. Hence the parietal peritoneum was divided longitudinally along its reflection upon the tumor; then the tumor was everted sufficiently to make another incision close to and parallel with the displaced transverse and ascending colon. Above and below, these two incisions were connected by semi-elliptic incisions, thus circumscribing the entire adherent area of the peritoneum. The cæcum and colon were now easily gathered into the napkin. Thus the vena cava came into full view. This being followed upward, the renal vessels were readily encountered and tied off. The blood supply under control, the tumor was rapidly shelled out of the fatty capsule, adherent portions being tied *en masse* and divided. A rent of the vena cava caused by the tearing of a small, inosculating vein, was closed by running cat-gut suture. The defect in the parietal peritoneum was rapidly closed by running suture, then most of the abdominolumbar wound was sewed up by through-and-through silk sutures, and a gauze packing was left in its posterior angle, draining both the situs of the vessels and the peritoneal cavity. Deep shock was successfully overcome, and the child made an uneventful recovery. Discharged cured, September 6, 1896. March, 1907, re-admitted with relapse, to which patient succumbed.

CASE XCV.—*Large round-celled sarcoma, and stone of right kidney. Nephrectomy. Improvement. Relapse in wound. General sarcomatosis. Death.* (*Hospital Records*, 1898, i, p. 580.)

Joseph M., age forty-eight, clerk, German. Admitted November 5, 1897. Twenty years ago sharp attacks of pain in right side; then again ten years ago; since then every few months similar attacks, which have become more severe and frequent the last four months, with fever, and difficult, painful urination. Night sweats. In right lumbar region large, elastic, solid tumor, reaching four fingers below ribs. Moderate fever. Urine, acid, 1013, albumin, pus, no blood. November 8, cystoscopy. Right ureteral opening intumescent, jet of cloudy urine escaping from it. Left ureter normal. November 23, nephrectomy. After delivery,

large ovoid stone was felt in dilated, thickened pelvis of kidney. Peritoneum stripped back from reflection until six inches of vena cava were exposed. Renal vein and artery tied off. Ureter divided. No shock, little hemorrhage. Uneventful recovery from operation. Wound healed except where drainage had been employed, from where grumous material began to escape early in February, 1898. Patient gaining in weight, though relapse was evident. March 17, physical signs of pulmonary deposit. Died April 30. (The stone weighed 97 grammes.)

CASE XCVI.—*Hypernephroma of right, pyelitic kidney. Nephrectomy. Cure.* (Contribution *loc. cit.*, p. 698.)

I. D., peddler, age forty-four, had been suffering for eight months from frequent exhausting hæmaturia; no history of traumatism. Operation, proposed in October, was declined. Readmitted January 19, 1897. In right loin of anæmic and emaciated man, a movable nodular tumor, not painful to touch; did not fluctuate. All other organs normal. Urine sufficient, acid, 1021, much pus, a few red blood-corpuscles, much detritus in glairy mucus. Left kidney not felt. January 22, cystoscopy. Vesical mucous membrane normal. Massage along the course of right ureter caused a cylindrical plug of consistent pus to escape from orifice of same ureter. Left ureteral orifice normal, repeated escape of clear urine from it seen. Vermicular material gained from right ureter came away through catheter. It consisted of pus, mucus, and blood. January 26, nephrectomy. Vessels of pedicle and the ureter separately tied. Healing uneventful; discharged cured February 28.

Pathologist's Report.—Pronounced alveolar arrangement of sarcomatous elements, which derived their origin from endothelium of smaller blood-vessels of kidney.

CASE XCVII.—*Sarcoma of left kidney. Nephrectomy. Cure.* (*Hospital Reports*, 1899, p. 215.)

Max R., forty-eight years old, admitted September 29, 1898. During past three months noticed a gradually increasing, painful growth in left lumbar region. General condition poor. In left lumbar region large, hard, smooth, movable tumor, extending downward to iliac crest, divided by a transverse ridge into an upper and lower half, moving with respiration; the colon to its inner side. No fluctuation. Urine alkaline, 1018, no albumin or formed elements. Slight febrile reaction (99° to 100°).

October 3, exploratory cœliotomy at outer edge of left rectus muscle. Tumor found to be the left kidney. Peritoneum closed, then, together with colon, peeled away from lateral abdominal wall. Enlarged kidney was brought into wound with difficulty, pedicle ligated, organ ablated. Uneventful recovery; October 20, discharged cured. Kidney: Little of parenchyma remaining. Sarcomatous tissue, degenerated in places.

CASE XCVII.—*Sarcoma of right kidney. Nephrectomy. Cure.* (*M. S. Hospital Records*, 1897, i, p. 395.)

Isidore D., age forty-seven, Russian, salesman. Admitted January 19, 1897. Hæmaturia of long standing; noted swelling January, 1896. Urination not painless, not frequent. Urine neutral, 1018, albumin and pus; had lost flesh, but regained some. Physical condition fair and normal, except for large, firm, lumbar tumor. January 26, 1897, nephrectomy. Oblique incision extending from tenth rib to three inches below and outside of umbilicus. Peritoneum opened and sewed. Difficult enucleation. Elastic ligature. Packing and suture. Uneventful recovery. Ligature came off February 19. Discharged cured March 3, 1897.

CASE XCIX.—*Sarcoma of left kidney. Nephrectomy. Cure.* (*Hospital Records*, 1898, ii, p. 945.)

Max R., age forty-eight, presser, Russian. Admitted September 29, 1898. Three months ago noticed painful swelling in left loin. Loss of flesh. On left side, from ribs to iliac spines was a hard, smooth, movable tumor, its lower portion more prominent, moving with respiration. Colon was overlaying it. No fever. Urine negative. October 2, nephrectomy. Probatory incision along left rectus border demonstrated retroperitoneal situs of tumor. Closure of peritoneum. External incision enlarged upward to costal border and downward to within two inches of ilium. Peritoneum reflected forward and separated from tumor. Vascular adhesions clamped and tied. An incision vertical to first incision, extending backward into loin, was added. Delivery, ligature of vessels and ureters, and ablation. closure of wound with drainage. Uneventful recovery. October 20, discharged cured, with small sinus.

Pathological Diagnosis.—Round-celled alveolar sarcoma.

CASE C.—*Sarcoma of right kidney. Nephrectomy. Cure.* (*Hospital Reports*, 1901, p. 194.)

Jacob S., thirty-seven years old, admitted May 8, 1900.

Four months ago began to have severe pain in right lumbar region, radiating over whole upper abdomen, with vomiting. Pain continued more or less severe, but vomiting had not recurred. For six weeks urination frequent; not painful. During past two weeks urine bloody; pain radiating to the right groin. Denied gonorrhœa or syphilis. Urine red, acid, albumin, faint traces of bile, no indican, urea 10 grains to ounce; red and white blood-cells, epithelial cells, mucous shreds, hyaline and granular casts. May 11, cystoscopy. Trigonum congested about both ureters. Harris segregator: bloody urine from both sides. June 5, nephrectomy. Last rib resected. Kidney very large. Pedicle tied with silk. Tumor found to come from lower part of kidney, upper part apparently healthy. The following day icterus; tenderness in right side of the abdomen; this disappeared in a few days. July 7, wound almost healed; urine normal; discharged cured.

CASE CI.—*Hypernephroma of right kidney. Nephrectomy. Cure.* (*Hospital Reports*, 1903, p. 168.)

Yetta E., fifty-six years old. Present trouble began four months ago with sharp pain in right lumbar region, radiating downward to groin, accompanied by hæmaturia. Had to stay in bed for several days. Since then similar seizures have appeared at shortening intervals, patient visibly losing strength and flesh. Admitted June 2, 1901. General condition, well nourished, anæmic. Temperature and pulse normal. Skin slightly icteric. Internal organs normal, except heart, which showed soft blowing murmur at apex, extending over pulmonic area. Large, nodular mass in right loin extending forward to within one inch of umbilicus. It could easily be manipulated, was fairly movable, and lay retroperitoneally. Urine between 25 and 35 ounces daily; albumin, many red cells, no pus, no elements suggestive of neoplasm. June 3, multiple aspirations; blood only was obtained. Temperatures normal, pulse normal. June 7, nephrectomy. Vessels separately deligated. Uneventful recovery. Discharged cured, July 28.

CASE CII.—*Congenital cystic adenoma of right kidney. Nephrectomy. Death.* (*Hospital Reports*, 1905, p. 175.)

Helen R., six months old, admitted July 4, 1904. The baby was well until six weeks before, when mother noticed that abdomen was becoming large and tender. Urination normal. On admission, infant well nourished. Internal organs normal. Ab-

domen much enlarged, owing to presence of large, smooth, firm, elastic tumor, which occupied right loin, extending from free border of ribs to pelvis below, reaching over to left umbilical and hypogastric regions. Urine normal. July 4, 1904, nephrectomy. Tumor easily removed by combined lumbar and abdominal incision, after size had been reduced by evacuation of fluid contents. The operation lasted about 20 minutes, but in spite of all precautions to prevent shock the child died therefrom two hours after the operation.

CASE CIII.—*Hypernephroma of right kidney. Nephrectomy. Death.* (*Hospital Records*, 1904-1905, iii, p. 507.)

Mendel A., age forty-six, Russian, engraver. Admitted January 5, 1905. For the past year noticed weakness, pallor, and loss of flesh; eight months ago observed swelling in right flank, which became painful. Urination normal. Poorly nourished, very anæmic and cachectic. Pulse hard, arteries sclerosed. Scaphoid belly. In the right lumbar space, reaching to iliac crest, was a large, hard tumor, freely movable; colon passing in front of it. Urine normal and ample. January 7, nephrectomy. Posterior parietal peritoneum removed with tumor, gap closed with suture. Separate ligation of vessels. Specimen, $4\frac{1}{2} \times 5 \times 3$ inches. Specimen: hypernephroma, to which was attached normal kidney. February 14, relapse of tumor in right loin. February 22, fungus growing out of wound. Died of exhaustion March 10.

CASE CIV.—*Carcinoma of left kidney. Nephrectomy. Cure.* (*Hospital Records*, 1904-1905, iii, p. 508.)

Dora E., age forty-nine, housewife, Russian. Admitted November 26, 1904. Gradual weakness and loss of flesh since one year; anæmic; systolic murmur. In left loin a huge, movable mass extending downward to ilium and laterally to mammary line. Temperature and pulse normal. Urine 1020, acid, urea 10.2 per cent., casts, scanty pus. December 12, nephrectomy. Resection of eleventh and twelfth ribs. Difficult excision. Elastic ligature *en masse*. Rallied well from operation. Ligature came away on twenty-sixth day. Gradual, slow closure of wound. Gradual improvement of general condition, complained, however, of much pain in loin. March 1, discharged with short sinus.

CASE CV.—*Hypernephroma of left side. Nephrectomy. Death.* (*Hospital Records*, 1905-1906, vii, p. 701.)

Morris Sch., age forty-four, shoemaker, Russian. Admitted

November 3, 1905. Ten months ago began to have dull pain in left loin. Four months ago tumor appeared; since then has lost 30 pounds in weight and has become weak. Urination frequent. On admission: Apparent bulging of left loin and hypochondrium. A hard, solid, somewhat movable tumor extended from costal border downward to below level of umbilicus, and inward to within three inches of median line. Urine, normal. November 4, nephrectomy. Elastic ligature. Ureter divided separately. Pathological diagnosis, hypernephroma. Before the wound was healed, that is in the middle of December, evidences of a relapse were incontestable. Fungoid masses filled up the wound and involved all the structures of the loin. On February 23, 1906, a fecal fistula made its appearance. Death on March 4.

CASE CVI.—*Hypernephroma of left kidney. Nephrectomy. Peritonitis. Death.* (*Hospital Records*, 1906-1907, vii, p. 853.)

Isidor S., age forty, Roumanian, carpenter. Admitted August 14, 1907. In April, after alcoholic self-indulgence, passed bloody urine; the same night passed bloody urine twice more. Then passed no urine whatever for 24 hours, feeling sharp pain in left loin. Since then frequent hæmaturia and renal colic, pain radiating into left testis. On admission, well-nourished, healthy looking man. In left loin and hypochondrium a firm, rounded, and somewhat movable tumor, of the size of a large potato. August 19, transperitoneal nephrectomy. Incision through left rectus; posterior peritoneum divided outside of colon. Easy development of tumor and separate ligature of vessels. Drainage through stab in loin. Closure of two peritoneal incisions and abdominal parietes. Pathological report, hypernephroma. Much distention and incessant vomiting of dark material followed after a fairly good first day. Lavage and attempts at reducing distention by enemata failed to bring relief. Died August 21. No autopsy could be secured.

CASE CVII.—*Adenosarcoma of right kidney. Transperitoneal nephrectomy. Cure.* (*Hospital Records*, 1907-1908, viii, p. 954.)

Solomon S., age twenty-two, Russian, clerk. Admitted March 19, 1908. Two years ago patient accidentally noticed a small, hard, movable mass in right loin, which has steadily grown in size. Four weeks ago noticed pain; since then tumor has

grown more rapidly. No urinary disturbance, no fever. On admission: An oval, hard, nodular mass, in right loin, beginning from border of ribs, extending downward to crest of ilium and inward to median line. It is slightly movable, not painful to touch. Temperature 101° F., pulse 96. Urine: amber, clouded, acid, 1025, no blood-cells, a few white blood-corpuscles. Cystoscopy. Bladder and ureteral orifices normal. Right ureter, no urine, only amorphous material. Left ureter, traumatic hemorrhage. Urea 2.2 per cent. May 21, transperitoneal nephrectomy. Incision 8 inches long through right rectus. Peritoneum again divided at external border of ascending colon, which was stripped toward the middle of body. Ligation of ureter, exposure of inferior vena cava, which led to pedicle. Ligature of renal veins and of two right renal arteries. Removal of a number of large and hard glands, which lay close to inferior vena cava, some of them high up under diaphragm. Lumbar drainage through counter-incision. Closure of peritoneal and external incisions. Specimen: kidney-shaped tumor the size of a muskmelon, upper pole still containing normal renal parenchyma. Pathological report: mixed tumor, myosarcoma, and adenosarcoma. Uneventful recovery. Discharged cured, June 7, 1908.

CASE CVIII.—*Hypernephroma of left side. Nephrectomy. Pneumonia. Death.* (*Hospital Records*, 1909-1910, x, p. 1467.)

Celia D., age fifty, housewife, Russian. Admitted August 22, 1910. Four weeks ago, while at sea, had first attack of sharp pain in left loin and iliac fossa with vomiting, the attack lasting four days. Lost 20 pounds in weight. No urinary disorder. On admission: Mitral insufficiency and stenosis. Temperature 101° F., pulse 100, respiration 24. Urine, amber, cloudy, acid, 1018, a few white blood-cells; no albumin or sugar. In left loin and hypochondrium, a large, smooth, globular, and very movable mass. August 30, nephrectomy. Easy extracapsular operation, with individual ligation of vessels. Specimen: Tumor size of a child's head. A strip of kidney tissue stretched over convexity of tumor. A sharp bronchopneumonia set in on second day after operation. September 7, patient very restless and at times violent, requiring restraint. After spells of violent excitement would fall into drowsiness verging on coma. Refused nourishment, was nourished by gavage. September 11, during a fit of violent tossing, the wound, seemingly healed, was torn

open. September 18, continued irrationality. September 24, wide area of dulness at base of right lung. Temperature 105° F. General convulsions followed by coma. October 3, died of pulmonary œdema. Pathological report, hypernephroma.

CASE CIX.—*Adenocarcinoma of left kidney. Transperitoneal lumbar nephrectomy. Cure.* (*Hospital Records*, 1909-1910, x, 1470.)

Blanche K., ten and a half years old, school girl, United States. Admitted August 21, 1910. Two weeks ago felt sharp pain in left loin. Urination normal. On admission: Pulse and temperature normal. Large, hard mass, slightly movable, extending to beyond median line of abdomen and below level of umbilicus. Urine amber, clear, acid, 1026, a few white blood-corpuscles. Urea 3.8 per cent. Cystoscopy: both catheters easily passed. Right side, abundant urine. Left side, no secretion whatever. Pirquet negative. Radiograph: no stones, homogeneous shadow. August 29: Long incision with convexity to median line. Peritoneum opened. A large plexus of distended veins seen under peritoneal covering of tumor. These were deligated and adherent peritoneum was removed together with tumor. Individual ligature of vessels; uneventful recovery. Discharged cured, October 3, 1910. Specimen, size of man's head. Pathological report: papillary adenocarcinoma.

CASE CX.—*Nephrolithiasis. Nephrolithotomy. Carcinoma of right kidney. Nephrectomy. Death.* (*Hospital Records*, 1910-1911, ii, p. 1297.)

Abram G., age forty-eight, Russian, tailor. Admitted December 19, 1910. Four months prior to this admission, nephrolithotomy was done at this hospital. No evidence of neoplasm at that time. Since discharge continuous pain in right loin, radiating to crest of ilium. Urination frequent, not painful. Urine clear. One month after discharge hæmaturia lasting one night, with urination every five minutes. Six weeks later similar attack; worm-like blood-clots passed. No fever. Since four weeks sinus opened in scar with scanty discharge. On admission, large, hard, irregular mass, size of fist, in right loin. Temperature 100° F., pulse 80. Urine: cloudy, amber, acid, 1020, no albumin or sugar, occasional red blood-corpuscles. No cystoscopy. Radiograph: no evidence of calculus. December 22, 1910: Reopening of oblique scar. Kidney much enlarged;

cystic at upper, very solid and hard at lower pole. Last rib resected. Cyst evacuated; 500 grammes of bloody fluid withdrawn. Difficult liberation of lower pole. Elastic mass ligature. Very large kidney consisting in its upper two-thirds of a multilocular retention sac; in its lower third, of a hard, solid tumor. Duration of operation, one hour and ten minutes. Deep shock. Died, December 23, twenty-four hours after operation.

CASE CXI.—*Hypernephroma of left kidney. Nephrectomy. Cure.* (*Hospital Records*, 1910-1911, p. 1299.)

Abe F., age forty-one, Austrian, butcher. Admitted March 8, 1911. Since three days dull pain in left loin, which grew into paroxysmal attack with chilliness and vomiting. Twelve hours before attack, passed bloody urine. No frequency of urination. On admission: Temperature 101.6° F., pulse 104. Neither of the kidneys could be palpated. Urine: clear, amber, acid, 1026; no tubercle bacilli, no sugar, no albumin; many red blood-cells; no casts. March 13, cystoscopy. Left side: loaded with red blood-corpuscles. Right side: clear. Radiograph: no evidence of calculus. March 16, nephrectomy. The high situation of the tumor made it inaccessible through usual oblique incision, hence a second vertical incision having exposed the eleventh and twelfth ribs. These were resected, whereupon it was found that the enlargement of the kidney mainly involved its upper pole. Reflection of peritoneum was stripped back; exposure of vessels; individual ligatures. Specimen: Kidney of normal size and shape forms the lower pole of mass. Upper part of mass the size of a fist. Pathological report: Mixed tumor. Hypernephroma and spindle-cell sarcoma. Uneventful recovery. Discharged cured, March 29.

OBSERVATIONS ON THE DIAGNOSIS OF RENAL TUBERCULOSIS, THE INDICATIONS FOR NE-PHRECTOMY IN ITS TREATMENT, AND THE TECHNIC OF THE OPERATION.

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THE kidney, when once infected with tuberculosis, is doomed to destruction. A very occasional case of supposed renal tuberculosis has been reported in which the diagnosis has seemed reasonably certain, and later examination has shown the case to be apparently recovered, and yet, despite such clinical evidence, there is no record of a case of cured tuberculosis of the kidney having been demonstrated at autopsy.

The disease is frequently present for a long period of time before it gives rise to distressing symptoms,—two, three, four, or five years, and then attention is called to it on account of the bladder involvement. Some cases may go on for many years without seeming to affect the general health of the patient. One case of our own gives a history which goes back for 22 years, and yet all of that time the patient's general health was excellent. The record of this case is as follows:

CASE I.—*Tubercular ulcer of the bladder. Tuberculosis of the lung. Tubercular epididymitis. Tuberculosis of the kidney.* The patient, a man, aged eighteen, had begun to have frequent micturition two years before admission, with occasional attacks of hæmaturia; constant hæmaturia for three weeks before admission, severe pain upon passing urine, has enlargement of both epididymes, with consolidation at apex of left lung.

Suprapubic cystotomy, by Dr. Lewis S. Pilcher, November 4, 1889: Transverse incision. The bladder when opened revealed in its base an eroded tubercular ulcer about one inch in diameter with overhanging edges; considerable sabulous matter and mucopus were removed from the bladder; the ulcer was curetted and

FIG. I.



X-ray of the case of tuberculosis of the kidney shown in the colored plate. The dense shadows have been produced by the putty-like contents of the kidney. The concretions in the ureter at the brim of the pelvis are clearly shown. The lower part of the ureter contains a nest of stones which is shown in the next figure. In this case the kidney and ureter as far down as the brim of the pelvis were removed.

FIG. 2.



Shows the pelvis in the same case as the previous figure. The concretions in the ureter near the pelvic brim are shown at the top of the picture. In the lower end of the ureter, just at the bladder, a collection of small phosphatic stones is seen. A close inspection of the picture will show that they are held in a cavity and fixed in position. At operation the kidney and ureter to the pelvic brim were removed, and the stones from the lower end of the ureter discharged themselves through the bladder within three weeks after the operation.

the cavity of the bladder filled with iodoform gauze; median perineal section was then done with introduction of hard rubber drainage tube (Watson) to base of bladder. By systematic antiseptic irrigations of bladder a gradual improvement in condition of patient was brought about. The suprapubic wound healed. The patient returned to college at the end of a year from the time of his entrance to the hospital, urinating ten times during the night.

In 1896, seven years later, he reported that his general health was good, urinating from 17 to 20 times daily, without pain. At times, when sleeping soundly, he would urinate unconsciously; still mucopurulent deposit in urine. There was still present a tuberculous deposit in one epididymis.

In April, 1906, he asked for treatment for the relief of his irritable bladder and frequency of urination. He was passing his water at least every hour, sometimes oftener. Repeated irrigations and the use of silver nitrate decreased the irritation of the bladder and increased his vesical capacity to nearly four ounces. Gradually, however, the frequency returned, and although he had periods of entire freedom from irritation lasting for three or four months at a time, still the condition grew gradually worse.

In June, 1910, a cystoscopic examination was made by Dr. Paul M. Pilcher and a small excoriated area was found on the right side of the bladder. This was curetted. The ureter openings could not be catheterized, inasmuch as the base of the bladder was very much deformed. The next day after leaving the hospital he returned on account of a violent hemorrhage into the bladder, which was controlled by rest and irrigation. He improved somewhat after this.

In January, 1911, he was examined at the Johns Hopkins Hospital by Dr. Hugh Young. X-ray examination showed a shadow four inches long and one and a half inches in diameter in the left lumbar region (Figs. 1 and 2), suggestive of a very large calculous mass.

No tubercular bacillus could be demonstrated in the urine at any time. The ureters could not be catheterized. The opinion was expressed that the irritability in the bladder was probably due to old tuberculosis of the left kidney.

Nephrectomy was done by Dr. L. S. Pilcher on May 3, 1911. The condition of the kidney was as shown in the specimen de-

picted in Fig. 3. The ureter was removed nearly down to its entrance into the bladder; in portions it seemed practically normal; at one point it was practically occluded by impacted calcareous concretions. The patient made a good recovery, both the upper and lower wounds being drained. The sinus closed after injections with bismuth paste.

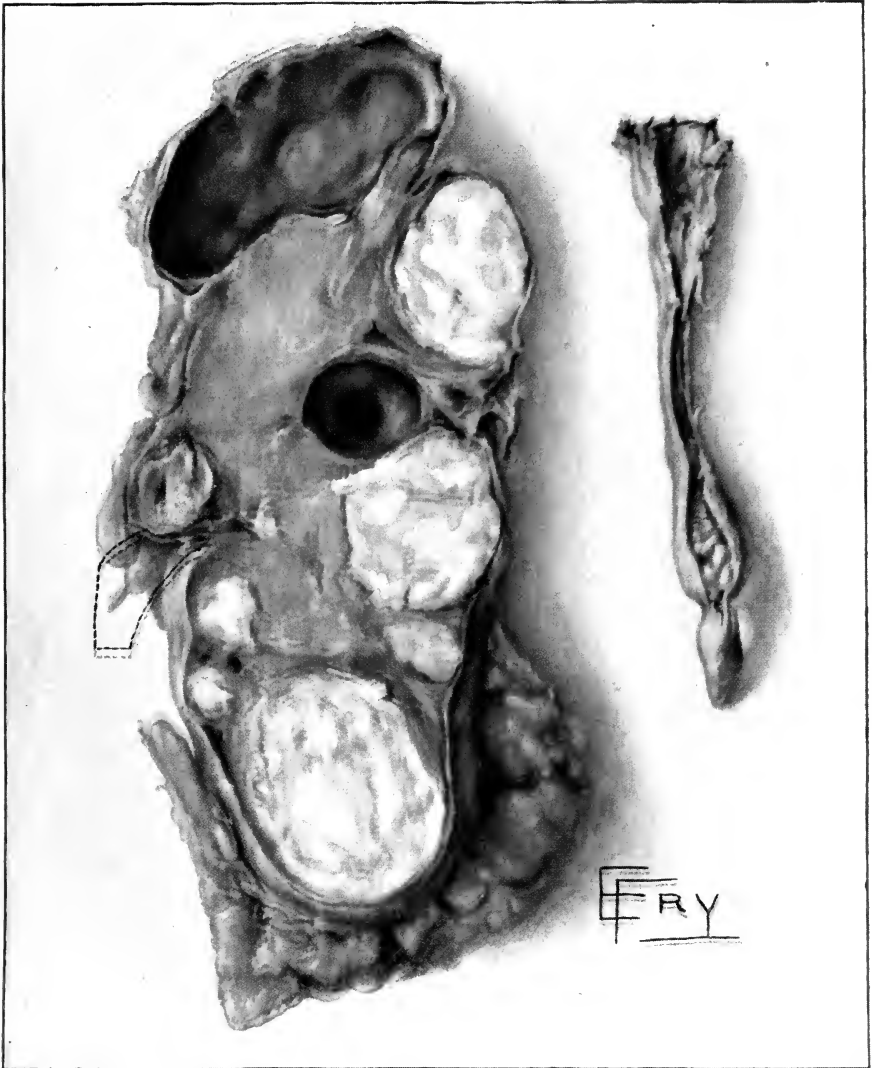
The large kidney was found to have undergone various transformations involving its whole mass. The pyramidal tissue had been replaced by fatty and fibrous tissue, and the cortex was replaced by a series of cysts, some filled with serum, but the most filled with a calcareous putty (see colored plate). The later effect of the removal of this degenerated kidney and ureter was most happy. The irritability of the bladder ceased so that the patient was able to retain urine for from four to five hours. He became robust, and within a few months married.

Another interesting feature of the case was the hard phosphatic mass which had formed in the ureter at the pelvic brim; this was removed and is shown in the colored plate. Another feature was the dilated lower end of the ureter, which contained several calculi (Fig. 2). These are well seen in the X-ray plate. After removal of the kidney, these calculi were spontaneously evacuated *per urethram*.

As a rule, however, after the disease has remained quiescent for a time, there comes a period of extension, with its train of distressing symptoms and gradual failing of the patient.

In some cases the clinical fact may be observed that during the period of active invasion of the disease, when the kidney is throwing off loads of pus and tubercle bacilli, and is secreting much more urine than its fellow, we frequently find evidences of active tuberculosis in other parts of the body—the lungs, the uterine adnexa, the epididymis, or the prostate. As the active processes in the kidney become controlled or develop into a slowly progressive lesion, the general health of the patient improves and the secondary or associated tubercular lesions show less and less evidence of activity and often entirely disappear, despite the fact that the lesion in the kidney still exists. It seems logical to suppose that there must have been some cases of tuberculosis of the kidney cured without

FIG. 3.



Tubercular kidney undergoing regressive changes after spontaneous arrest of the tubercular process with a history of twenty-five years since the inception of the disease. Note the cortex replaced by a series of cysts, some serous, some filled with calcareous material; note the pyramidal tissue replaced by fatty fibrous tissue; note the ureter irregularly dilated and containing a quantity of calcareous material. Chief symptom, persistent vesical irritability. All symptoms relieved by removal of the degenerated kidney.



removal of the kidney, but the fact still remains that no conclusive evidence has been produced to substantiate this inference.

Tuberculosis of the kidney is characterized by fewer symptoms referable to the kidney than any other inflammatory lesion of that organ, and at the same time it may present any of the classical signs which we are accustomed to associate with other lesions.

Calculi form in tubercular kidneys and befog the diagnosis. Plugs of blood and pus block the ureter and give rise to renal colic; multiple strictures of the ureter form, and produce hydronephrosis and hydro-ureter, with their train of symptoms. A persistent hæmaturia or a sudden large hemorrhage may be the only definite signs of the disease. Even the X-ray may deceive us, for the large accumulations of putty-like material which forms in the chronic cases, and the harder concretions which we occasionally see, give shadows on the plate which are very misleading (see Figs. 1, 2, 3 and 4).

How much value are the various clinical manifestations in establishing a diagnosis?

1. *The symptoms referable to the kidney itself:* Palpation usually shows some enlargement of the organ, which is moderately tender, but it is frequently the case that the companion kidney is more greatly enlarged and more tender. Pain referable to the kidney is not a prominent symptom until late in the disease and may be complained of only on the side of the normal kidney. Some cases, however, have severe colic due to the plugging of the ureter, while others suffer from moderate and long-continued pain, but these cases are the exception.

2. *The bladder symptoms:* These are by far the most prominent feature of the disease and consist of painful and frequent urination, both day and night, and a marked polyuria and pyuria.

3. *The physical examination:* Very little can be learned from this. Frequently we find evidences of tuberculosis in other parts of the body, especially in the lungs and epididymis

and vas deferens. Until late in the disease, the tubercular involvement of the kidney seems to affect the general health of the patient very little.

4. *Chemical examination of the secretions:* The microscope and test tube often give us our first clue to the nature of the disease. We find first a marked polyuria, which is quite a constant phenomenon. The urine is pale, acid in reaction, of low specific gravity and contains albumin in proportion to the changes in the kidney and the amount of pus present. Pyuria is a constant feature and is very markedly increased when the bladder is involved. In an advanced case the urine collected from the bladder will be thick with pus and the flocculent whitish flakes of pus and necrotic tissue adhere to the side of the glass container as the fluid stands, settling very slowly to the bottom of the glass. If in the same case the catheter is passed into the ureter leading from the diseased kidney, the specimen collected will be found to be quite different from that collected from the bladder—the amount of pus being very markedly less, although only one kidney is affected. The specimen from the kidney direct looks like clear water, is of very low specific gravity and shows very little macroscopic pus.

Hæmaturia is one of the less frequent clinical manifestations of the disease and occurs in about 25 per cent. of the cases. A few blood-cells mixed with the pus-cells are frequently found, especially when there is an ulcerative cystitis. When hæmaturia does occur it is apt to be fairly small in amount, but continuous.

Tubercle bacilli: It is not always possible to discover tubercle bacilli in the urine. However, they are always present at some stage of the disease. Their presence will give us some clue as to the stage of the disease and the condition of the kidney from which they come.

It has been our experience that when we have a miliary tuberculosis of the pelvis of the kidney, tubercle bacilli are always found in large numbers. When we have an ascending tubercular pyonephrosis, with extensive destruction of the

FIG. 4.



Shows shadows in another case of tuberculosis of the kidney, in which the same putty-like material was present in the kidney substance. The case was one of continuous hæmaturia, which was relieved by removal of the kidney.

FIG. 5.

FIG. 6.

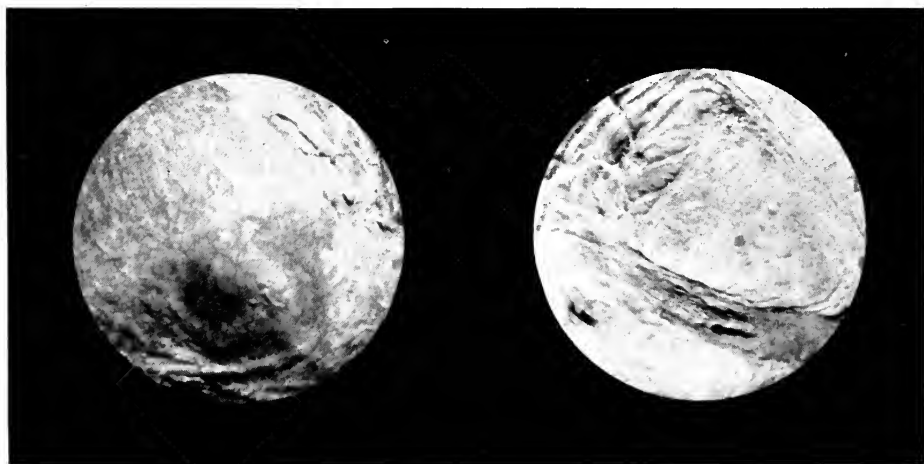


FIG. 5.—Shows an area of tubercular infiltration of the bladder wall. The pre-ulcer stage as here seen is characteristic of the disease. (Pilcher's Cystoscopy.)

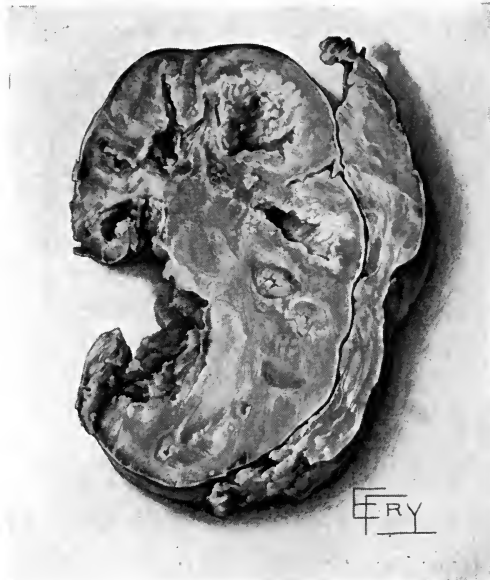
FIG. 6.—Showing the stiff, dilated ureter opening corresponding to a tubercular kidney. (Pilcher's Cystoscopy.)

FIG. 7.



Tubercular kidney, with abscess formation in upper pole and tubercular pyelitis. In this case there were many tubercle bacilli found in the urine, which is characteristic of such a condition.

FIG. 8.



Tuberculosis of kidney. Note multiple tubercular abscess cavities in the cortex and in the pyramid-pelvic portion. Note the thick pseudocapsule from inflammatory thickening of the perinephric fatty tissue. In such a case it is difficult to demonstrate tubercle bacilli in the urine.

kidney, we generally find tubercle bacilli with enormous amounts of pus. With an old caseous tuberculosis of the kidney, especially where very little secreting surface is left, the amount of pus secreted is smaller and we seldom find tubercle bacilli. Therefore, if in a given case we find many tubercle bacilli and few pus-cells, we do not expect a marked destruction of the kidney, and the case presents the possibilities of benefit from the use of tuberculin injections.

If a case presents a large number of tubercle bacilli, enormous amounts of pus, a greatly enlarged kidney, we suspect an ascending infection and a possible bilateral involvement. An example of this type is shown in Fig. 7.

If we have all of the clinical findings of tuberculosis of the kidney of long standing, without the continued presence of tubercle bacilli in the urine and with very little change in the health of the patient, we expect to find a kidney fairly well destroyed, with large deposits of putty-like, inspissated pus impregnated with lime salts replacing the kidney tissue; such cases usually give symptoms of long-continued bladder irritability with pyuria.

5. *Instrumental examination:* This is indicated in almost every case. The presence of miliary tubercles, tubercular nodules, tubercular ulcers, and marked deformity of the ureter opening are strong confirmatory evidence of tuberculosis of the kidney, for I think it may be safely stated that in 95 per cent. of the cases tubercular involvement of the bladder is secondary to tuberculosis of the kidney. Without going into the details of a cystoscopic examination in these cases, it may be stated that a diagnosis of tuberculosis of the kidney can almost always be made even when tubercle bacilli are absent from the urine. A study of the meatus ureteri (Figs. 5 and 6), the urinary reflux, the results of ureter catheterism, and an examination of the urine collected separately from the two kidneys, together with functional tests of each kidney, will practically establish the diagnosis in nearly every case. It may be that we can only diagnose a pus kidney on one side and a normal kidney on the other, without being able to say definitely

that the case is a tubercular one. It must be remembered also, in making a functional test, that only a limited portion of the kidney may be involved and therefore the function of the organ may be perfectly normal.

The character of the urine from each kidney varies from time to time and it is instructive to compare the output from a tubercular and a non-tubercular kidney in the same patient at an early and during a later stage of the disease.

TABLE OF COMPARISON BETWEEN THE TUBERCULAR AND NON-TUBERCULAR KIDNEY.*

| | Tubercular Kidney | | Non-tubercular Kidney | |
|----------------------------------|--|---|---|---|
| | Early Stage | Late Stage | Early Stage | Late Stage |
| Amount | Greatly increased | Changeable | Normal | Increased. |
| Color..... | Very pale, colorless | Turbid | Normal | Pale. |
| Reaction | Acid | Neutral or alkaline. | Acid | Acid. |
| Albumin..... | Trace | Heavy trace | None | Trace variable |
| Specific gravity.. | Very low, 1002-1008 | Low | Normal | Low, 1008-1012. |
| Indigo-carmin... | Fifteen to twenty minutes, pale green | May find no reaction, or late | Dark blue in five to ten minutes | Delayed ten to twenty minutes. |
| Phloridzin injection 0.01 gm. .. | Sugar appears late; thirty to forty minutes | No reaction or only after an hour | Sugar appears in ten to fifteen minutes | Sugar appears in fifteen to twenty minutes. |
| Animal injection. | Positive for tuberculosis | Positive for tuberculosis | Negative | Negative. |
| Microscopic examination | Tubercle bacilli, pus-cells, occasional blood-cells, renal cells | Tubercle bacilli; large amount of pus; rarely blood-cells, hyaline and granular casts | No bacteria; few renal epithelia | No bacteria; large amount of granular renal epithelium; few hyaline casts few leucocytes and red blood-cells. |

*From the writer's work "Practical Cystoscopy," page 325.

6. *Rectal and vaginal examination:* Here we have really a very valuable guide in our diagnosis, especially in those cases

where it is impossible to catheterize the ureter on the diseased side. In a number of cases the writer has been able to make a definite diagnosis by this means alone, although it does not tell us the condition of the companion kidney. Almost invariably we find the lower segment of the ureter thickened and cord-like on the diseased side and easily palpable to the examining finger. It is also sensitive.

7. *The X-ray*: We have found this an important aid in certain cases where it has been impossible to catheterize the ureters. Where the disease has been of long standing, the X-ray plate may show shadows of varying density, due to abscess formation or to large collection of phosphatic deposits. The X-ray examination is important more as confirmatory evidence.

8. *Surgical operation*: At times it is impossible to determine definitely the exact nature of the disease, or, in fact, its location, without exploratory operation, but this is the great exception. We cannot agree with surgeons who advocate bilateral exposure of the ureters and catheterizing the kidney pelves directly, for we believe that unless the disease has reached an inoperable stage, a diagnosis can be made with fair certainty by other means.

It may be said in general, that while the symptoms arising from tuberculosis of the kidney may be interpreted as those due to a non-specific cystitis, other suppurative diseases of the kidneys, pyelitis, nephrolithiasis, tumors, and renal varix, yet the disease is not easily confused with them. The cardinal symptoms are the long-continued pyuria, which resists all local treatment of the bladder, marked polyuria, frequent and painful urination, day and night, a contracted and intolerant bladder, the presence of tubercle bacilli in the urine. Confirmatory evidence is to be had as the results of cystoscopy, ureteral catheterism, and the X-ray.

INDICATIONS FOR TREATMENT.

Every individual case must be judged for itself. In general it may be said that in all cases where there is extensive tuberculosis of the lungs, removal of the kidney should not be

considered; where, however, there is only a slight involvement of the lung, nephrectomy may be safely done.

In cases of bilateral involvement, operation should be done only as a last resort, and especially in these cases must the decision rest with the individual surgeon. In one case of my own, nephrectomy was carried out on one side owing to the extensive septic tubercular process in the one kidney, while the other kidney was also known to be involved. In this case all the septic manifestations were controlled and the patient was restored to a fair degree of health, until last heard from two years after operation.

A second case of bilateral involvement, in which neither kidney was very markedly diseased, when first seen, no operation was done. For seven years the patient has been made comfortable by occasional applications to the bladder and use of the X-ray. At the end of seven years, however, she is rapidly going down hill, both kidneys are enormously enlarged and equally affected, her lungs are involved, and her intestinal tract shows evidence of tubercular lesions. In this case all of the distressing symptoms have been kept under control for seven years without operation.

A third case is one in which there was an ascending infection in a young lad seventeen years of age. He was having very active symptoms referable to the right kidney, with marked sepsis, high temperatures, and losing ground very rapidly. In this case it was thought best to remove the kidney, which was done. He lived in comparative ease for four or five weeks, when the companion kidney, which was also involved, became incompetent, and he died six weeks after the operation. This is the only case of tuberculosis of the kidney that I have operated on, where the patient died within a year of the operation; perhaps it was an error in judgment, although the septic condition present demanded immediate relief. The kidney in this case is seen in Fig. 9.

There are certain advanced cases in which it is inadvisable to do a nephrectomy, even where we do not know positively that both kidneys are involved. The only absolute guide which can be set down in choosing these cases is an estimate

of the renal function and the degree of other involvement of a tubercular nature throughout the body. Aside from these objections, it is our rule to advise nephrectomy in every case of unilateral tuberculosis of the kidney, providing the companion kidney shows a normal secretion, or an almost normal secretion.

TECHNIC OF NEPHRECTOMY.

In all of our cases, so far, we have performed the nephrectomy through a lumbar incision. The incision starts parallel with the outer border of the erector spinæ muscle, which usually is two and a half to three inches from the spines of the vertebræ. Beginning at the lower border of the eleventh rib, the incision is carried downward and slightly forward to a point an inch above the crest of the ilium, and then is carried forward, parallel to the crest of the ilium (Fig. 10).

The posterior layer of the lumbodorsal fascia is divided, together with some of the fibres of the latissimus dorsi muscle. Without further cutting of any muscle structures, the finger is entered into the triangle just below the twelfth rib, and a blunt dissection is made with the fingers, separating the lowest insertion of the serratus posterior inferior from the posterior edge of the internal oblique muscle. The remaining layer of the lumbar fascia is divided and the fatty bed of the kidney itself comes into view. The quadratus lumborum muscle is posterior to the line of incision. The ilio-inguinal and iliohypogastric nerves are usually found running along the under surface of the posterior muscle mass. These should be carefully identified and retracted out of the way. After the muscles have been found, the incision is completed downward and forward by cutting the fibres of the internal oblique muscle at right angles to its attachment to the crest of the ilium. The incision is completed above by freely exposing the eleventh and twelfth ribs.

Even with this wide exposure of the perirenal space, it very frequently happens in these cases of tuberculosis of the kidney that we have not sufficient room to carefully secure

the pedicle, and to still further widen this space it has been our custom to resect the twelfth rib in order that it might be retracted upward. Dr. W. J. Mayo (*ANNALS OF SURGERY*, vol. iv, p. 64) has shown us that the rib may be dislocated upward by dividing its muscular and fibrous attachments, especially the quadratus lumborum and the lateral arcuate or lumbocostal ligament, which binds the twelfth rib to the transverse process of the first lumbar vertebra. By putting a retractor under the angle of the twelfth rib, the exposure of the kidney pedicle is much more complete. Dr. Mayo tells us that in this way danger of injury to the pleura may be avoided, but in one case of our own in which this was done, the pleura and the diaphragm were ripped from the rib by the forcible retraction.

It is important before proceeding to the removal of the kidney to complete all of the details above mentioned, for with a proper exposure and plenty of room to work in the kidney may be removed much more quickly and the pedicle may be more easily secured.

After this has been accomplished, the kidney is separated from its perirenal attachments by blunt dissection with the fingers, a ligature of catgut securing the upper mesh of venules which frequently enter the upper pole of the kidney, and a similar ligature surrounding the tissue attached to the lower pole before they are divided from the kidney (Fig. 11). The kidney is brought up into the wound and the pelvis and pedicle are cleared of all fatty tissue and adhesions by a blunt dissection with the finger covered with gauze (Fig. 12). It is remarkable oftentimes how quickly and completely this can be accomplished. It gives a much better exposition of the vessels entering the kidney and allows of their being more perfectly secured by ligature. A heavy chromic gut ligature is then placed around the vessels entering the kidney and the ligature is tied. A second chromic gut ligature is also applied before the vessels are cut. The ureter is not disturbed at this time.

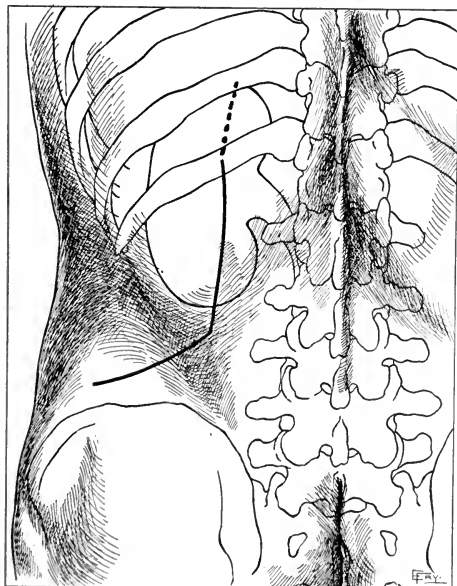
After the vessels have been cut, the tissues are stripped

FIG. 9.



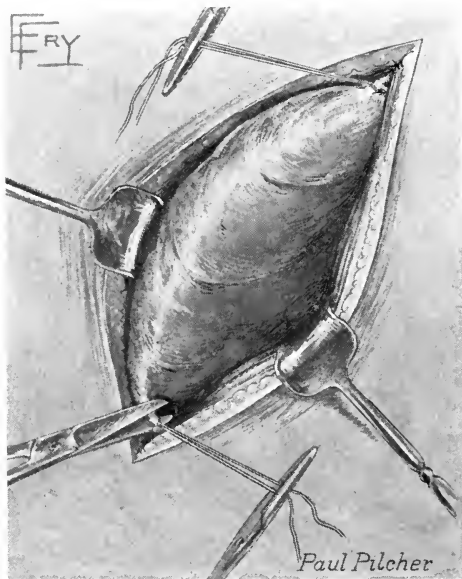
Tubercular kidney, showing abscess formation with subcapsular hæmatoma.

FIG. 10.



Line of incision for exposing kidney.

FIG. 11.



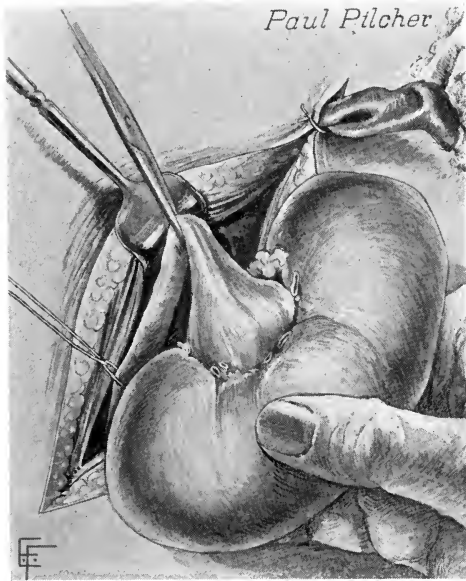
Freeing the kidney in order to bring it more freely into the wound. It will be found that there are generally vessels entering the kidney both at its upper and lower pole. In order to prevent hemorrhage these tissues, whether they contain vessels or not, are tied with catgut ligature and divided.

FIG. 12.



Nephrectomy. The kidney has been brought into the wound; the posterior surface is shown. The small vessels at the lower pole of the kidney are first ligated and cut; the pelvis and first portion of the ureter are identified; a ligature carrier is passed underneath the vessels and the vein and artery tied by a single, strong catgut ligature.

FIG. 13.



Nephrectomy. In removing an infected kidney, whether it be from tuberculosis or other bacteria, the vessels having been ligated, the kidney and ureter dislocated to the lower angle of the wound, the upper portion of the wound is closed before the ureter is cut. This is done to prevent infecting the deeper portions of the wound from which the kidney has been removed.

up from the ureter for a distance of three or four inches and the kidney, still attached to the ureter, is carried down to the lowest angle of the wound. Then, before dividing the ureter and exposing the wound to any infection, the upper portion of the wound is closed, the deeper layers being brought together by sutures of catgut and the fascia accurately resutured and the muscle masses brought into apposition, obliterating all dead spaces (Fig. 13). This practically closes the longitudinal arm of the incision.

Treatment of the Ureter.—Unless the ureter contains concretions or deposits of lime salts above the brim of the pelvis, no attempt is made to remove more than the first three or four inches of the diseased ureter. It has been our experience that no matter whether the ureter be a contracted thickened ureter with a narrowed strictured lumen, or an enormous hydro-ureter, the after-course of the case is just as satisfactory, if the ureter is properly treated. Where concretions or phosphatic deposits are present, we attempt to remove these if they lie above the brim of the pelvis, otherwise they are not disturbed.

In the ordinary case, after the upper portion of the wound has been closed, the lumen of the ureter is injected with about 40 minims of pure carbolic acid at a point as far down on the ureter as practicable (Mayo). The needle is then removed and the ureter is ligated above and below the point of injection. The ureter is cut between the two ligatures and the stump of the ureter again carefully cauterized. It is then allowed to drop into the depths of the wound. A cigarette drain is carried to the surface from the cut end of the ureter and the rest of the wound is closed by careful suture. We have had no trouble from the carbolic acid which we have injected, and believe that none of it reaches the bladder, owing to the diseased condition of the ureter itself, which rapidly takes it up.

Following out this special technic, we have obtained primary union in three of our recent cases, the patient being out of bed entirely healed at the end of two to three weeks.

Injury to the Pleura.—Our experience agrees with that of Dr. Mayo, in that we do not fear injury to the pleura in these operations, although it has occurred occasionally. In no case has there been collapse of the lungs, and in no case has there been any unpleasant after-effect therefrom.

Treatment of the Bladder.—Post-operative treatment of the bladder is a question which will not be discussed here, further than to say that, as a rule, very little need be done to the bladder after the source of the tubercular infection has been removed.

ACUTE HÆMATOGENOUS INFECTION OF ONE KIDNEY IN A PERSON APPARENTLY WELL.

BY GEORGE K. DICKINSON, M.D.,

OF JERSEY CITY, N. J.

"THE first thing essential to a correct diagnosis of certain morbid conditions is that the practitioner must be aware that such conditions do sometimes exist." This remark is peculiarly applicable to the infections which run a dramatic course and are but rarely observed. The study of the mistakes in diagnosis of our best clinical surgeons demonstrates that very acute fulminating lesions met for the first time are slowly diagnosed and often misunderstood, sometimes at the expense of a life.

A surgeon may be well read in literature, his mind may be alert to the possibilities of the acute abdomen, and yet when an anomalous case arises diagnosis and proper treatment are often so delayed that the case ends in a tragedy.

So much is heard of the acute appendix and gall-bladder, of perforations of the stomach and duodenum, and of other common lesions that the general practitioner seldom delays long in obtaining counsel, nor does the surgeon wait for positive indications before operating. Very little is heard, however, of the acute kidney. We are not compelled to read titles which appeal forcibly like the headlines in the daily press. Our literature is not teeming with case reports to take our attention, yet the profession knows, almost subconsciously, that an acute kidney may exist, but in differentiating a diagnosis is prone to think of the more commonplace, and rules with the probabilities.

In retrospect it is not to be wondered that the kidney should more often be the site of pyogenic inflammation, for its one province is to excrete active bacilli from the blood.

In all infections, typhoid fever, pneumonia, tuberculosis, etc., the kidney excretes live germs, and is not infected. Pyelitis, the result of the passage of germs, is not uncommon.

The blood supply of the kidney comes through the renal artery (which is very large considering the size of the organ), and also anatomically and freely from the blood-vessels of the pelvis, particularly in the female. The resisting power of the healthy kidney to infection seems to be as great as the substance of the liver, which is constantly bathed with impure blood. Both of these organs have that acquired immunity which comes from the evolution of a function.

A man in apparent health may have some defect in one kidney which lowers its vital resistance. Again, of all the internal viscera, the kidney is most liable to suffer from traumatism. Clinical histories tell us that mild trauma may sometimes snap a kidney in half. May not a mild trauma of every-day life, not noticed nor remembered, temporarily at least reduce the vitality of one kidney? Brewer has well shown that a healthy kidney will eliminate pathogenic germs thrown into the ear of a rabbit, whereas if that kidney be slightly traumatized, we may find infarcts.

The symptomatology of an acute kidney as written varies with the intensity of the infection. A subacute inflammation with the lesion progressing over more than ten days, in which there is no marked enlargement of the organ, gives time for study and examination and a symptomatology pointing directly toward the diseased organ. But even under these conditions our best men have erred in diagnosis. The pain may be referred, points of tenderness may not be only at the costovertebral angle and over the kidney, but may also be present on a line of the ureter or even across the abdomen. The systemic reaction may be intense; there may be high fevers, chills, perhaps nausea and vomiting, and marked mental anguish. Cystoscopy may be negative, and a catheter passed (if conditions will allow) show little difference in the urine of the two organs. Sometimes a few leucocytes will come down from the urine of the infected organ.

CASE I.—F. H., forty years old, married man of excellent habits and fine physique. In childhood suffered from diphtheria, mumps, and measles. Years ago while in Panama was sick with Chagres fever, leaving a somewhat enlarged spleen. There was no history of gastro-intestinal lesion. He was not a drinker. There was no history of trauma.

While feeling perfectly well, with mental and physical content, was taken with pains in the upper left abdomen, in the evening of January 20, 1912.

On the twenty-first, colicky pains continued.

On the twenty-second, seen by Dr. G. A. Krauss, who gave some medical treatment, relieving him for four hours.

On Tuesday, the twenty-third, the family physician, Dr. F. E. Lambert, was called on account of the severe continuous pains in the left loin. Further relief was obtained by medication. Not at this time nor subsequently did the pain extend into the genitalia. Reported to have had two chills, each of ten minutes' duration, one in the morning, one in the afternoon.

On Wednesday, the twenty-fourth, not being any better and suffering severely, was referred to Christ Hospital, reaching there at 8 P.M. Rectal temperature was 105° ; pulse 108; condition fair, but was writhing in agony, with pain in the left upper quadrant. Pain was of colicky nature and extended down to the brim of the pelvis. There was no increased frequency of micturition. Palpation elicited extreme tenderness in the costo-vertebral angle on the left side, also anteriorly. In addition there was general abdominal tenderness.

His condition did not permit of cystoscopy. Urine was acid; normal in amount. In spite of morphine administered hypodermically little relief was obtained. Time was spent in differentiating between descending calculus, associated with some pyelitis and renal infarct. The latter was thought of because of Brewer's paper and experiments. *Urinalysis*: specific gravity 1025; no sugar; trace of albumin; occasional hyaline cast and few white blood-cells. *Examination of feces* for blood, negative. *Blood count*: white cells, 19,000; 83 per cent. polynuclears.

On January 26, chill, at 10.30 A.M. At 11.20 A.M. he passed a worm-like cast of ureter. Unfortunately this was lost, although referred to the pathologist.

It was now decided that further delay was not wise, and at

3.30 P.M. of the twenty-sixth, under ether anæsthesia, the loin was opened through an incision running parallel to the twelfth rib. There was two inches of fat to muscle and aponeuroses. The muscles were thick, firm, and well developed. The deep fat as well as the perirenal was œdematous and broke away easily. The kidney was enormously swollen, capsule tense, shiny, and of a deep purple color; uniform in appearance. It could not be measured, but its estimated length was 17 to 20 cm. and it was fully 12 cm. broad. A trochar was plunged into the pelvis. There was no discharge; the finger was pushed in and no calculi discovered. After exploration there was a free gush of blood. Patient's temperature at the time of operation having dropped to 101°, his pulse also falling, and with the recollection of good results obtained by some surgeons through drainage, such was instituted. After the operation he was relieved of his colicky pain, but for it was substituted a severe soreness.

In the evening of the same day his temperature and pulse commenced to rise and he died the following night, on January 27.

An autopsy was permitted and the kidney referred to Dr. G. E. McLaughlin, chief of the laboratory, who made the following report:

"The right kidney showed a mild parenchymatous nephritis; the left kidney, severe parenchymatous nephritis with very small multiple abscesses scattered throughout, and septic infarct at its upper pole. There was a moderate pyelitis. Cultures made from these multiple abscesses gave pure growths of *Bacillus coli communis*, which were decidedly virulent. This case was undoubtedly one of hæmatogenous infection."

The clinical history of this unique case, in perspective, when taken as a whole, clearly indicates that the proper procedure would have been a cœliotomy with removal of the kidney immediately on the arrival of the patient at the hospital. One's personal experience in conditions so rare is a poor guide to treatment. The dissertations in our literature on acute kidneys and infarcts are not sufficiently reiterated to produce a strong mental impression, and this recital is given in the hope that other surgeons in a similar predicament may profit by this case.

ACUTE UNILATERAL INFECTION OF THE KIDNEY.

BY F. W. RINKENBERGER, M.D.,

OF TACOMA, WASH.

FROM reading the article by Dr. F. J. Cotton in the *ANNALS OF SURGERY* for November, 1911, I am impelled to report a case and make some observations upon this subject, which certainly has not received the attention it deserves.

Descriptions have only lately begun to appear in the textbooks, and such works as Johnson's "Surgical Diagnosis," Brewer's and Mumford's monographs on surgery, Watson and Cunningham on genito-urinary diseases contain articles, while most of the other late American and the foreign works either do not describe the condition or else do so in a faulty manner.

Brewer and Cobb were the pioneers in working out the disease as an entity, and Cobb's article in the *ANNALS OF SURGERY* for November, 1908, is probably the best exposition of the subject to be found.

Following is a report of my case:

Mrs. A. T., aged 24, I-para and a housewife by occupation. Family and personal history negative. Was first seen on the morning of December 30, 1908, when the following conditions presented themselves: The patient had been seized with a severe pain in the abdomen at about 4 A.M.; there was slight nausea and a great deal of pain over the abdomen but no localized tenderness. The temperature was in the neighborhood of 103° and the pulse 120. As it was impossible to make an absolute diagnosis, the patient was placed in the Fowler position and an ice-bag applied to the abdomen. All food was withheld. Removal to a hospital was advised and refused. During the day the condition was much the same and there was no remission of temperature the next morning. During the second day (December 31) the condition was still much the same, except that the patient was

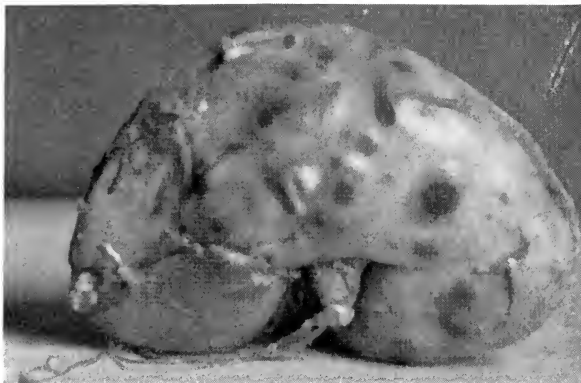
all the time growing more septic. At 7 o'clock that night the patient consented to be removed to the hospital, and was admitted there with a temperature of 103° and a pulse of 140. The leucocyte count was 18,000. The temperature rose steadily during the night, and at noon of the third day (January 1) was 104.4° . The patient began menstruating on this day, and I was able to elicit marked tenderness in the right costovertebral angle for the first time. The condition was distinctly bad, with a high temperature and a falling leucocyte count and a very septic appearance of the facies. At eight o'clock that night the patient was taken to the operating room, and so certain was I by this time of my diagnosis that the incision was made directly over the kidney and the organ delivered. As soon as the kidney was seen a nephrectomy was determined upon and performed, a gutta-percha drain being left in the wound. The patient was on the table less than 50 minutes and was returned to bed without shock. At eight o'clock the next morning the temperature had fallen to 99° . Convalescence was uneventful, and the patient left the hospital on the fourteenth day. I examined her urine 18 months and two and a half years following the operation and it was normal in quantity and character.

The importance of this condition lies in the difficulty experienced in its diagnosis. That difficulty militates against the early institution of proper treatment, which is usually nephrectomy. Failing the proper treatment, many of these cases must of necessity result fatally.

The condition is one of early adult life and is much more common in women and apparently in those who have borne children. It is particularly liable to be mistaken for appendicitis, cholecystitis, peritonitis, or some other common intra-abdominal emergency. In many of the earlier cases, when the disease was just beginning to be recognized, the patients were mostly operated upon under a mistaken diagnosis, and the true state of affairs was only recognized when the abdomen had been opened. In fact Cobb goes so far as to say that in some acute fulminating cases it may be impossible to make the diagnosis without an exploratory opening.

The onset is usually very acute, and a peculiar feature

FIG. 1.



Anterior surface; acute unilateral kidney infection.

FIG. 2.



Posterior surface; acute unilateral kidney infection.

FIG. 3.



Kidney split; acute unilateral kidney infection.

is that it occurs in persons who just before had been apparently entirely well. There may or may not be a chill, and there is usually a great deal of pain which may be generalized over the whole abdomen or localized on one side.

The temperature ranges much higher than is common in the other intra-abdominal emergencies, and nausea and vomiting are not such prominent features as is usual in acute appendicitis. This, while only relative, should cause one to think of some other condition than acute appendicitis, for it is with the latter that acute kidney infection will be most frequently confounded.

The one constant symptom is costovertebral tenderness, and from what I can find in the literature it has been present in all the cases in which it was sought. The urine may show some changes but I do not believe this is constant. Brewer holds that there are changes in all cases but Cobb does not agree with him. In my own case, while the patient was not cystoscoped, there was no appreciable change either chemically or microscopically. It is logical to suppose that when there are changes present they would be those which Brewer has described, namely, a diminution in the amount on the affected side as well as the appearance of red cells, and later if the patient survived long enough pus should be present.

We have then as a basis for diagnosis the following points, namely, an extremely sick patient who a short time before was apparently well and who will show a high temperature, rapid pulse and respiration, high leucocyte count, tenderness probably over the whole abdomen and certainly over the costovertebral angle, and possibly some urinary changes. This is a description which will show the difficulty of differentiation from other intra-abdominal emergencies, and I am sure will test the diagnostic acumen of the best.

The pathology of the condition is simply that of an infarct which has added to its ordinary gravity the extremely dangerous complication of being highly infective. The specimen will therefore show the regular wedge-shaped lesions

under the capsule and corresponding to the position of the end arteries. The gross appearance (as is beautifully shown in my specimen) will show the dark areas just under the capsule. A section will demonstrate their wedge shape. Later these areas may and probably will become purulent, and in some cases the entire kidney may become a pus sac. The infecting organism in the great majority of cases is the colon bacillus.

From Dr. Cotton's description of the pathology in his cases I am somewhat doubtful of their being typical examples of the condition under discussion. His description does not correspond to the reported cases and to my own case. He reports small whitish areas under the capsule, while the photographs of Dr. Cobb's cases and my own show large dark purple areas. As to mobility being a prominent etiological factor, it was not present in my case and I have not seen this feature commented upon before.

The treatment is essentially surgical and in most cases will offer the best hope of success if nephrectomy is performed. If there are only one or two areas of infection and it seems possible to reach all the pathology, it will probably be better in some cases to split the capsule and drain. However, in some of the reported cases in which this course was pursued, it became necessary later to do a secondary nephrectomy and with vastly increased difficulty. If there is doubt as to the functional capacity of the other kidney it is safer not to perform a primary nephrectomy.

ADHERENT HERNIAS OF THE LARGE INTESTINE.

BY J. LOUIS RANSOHOFF, M.D.,
OF CINCINNATI.

SLIDING hernia of the sigmoid is a subject which as a rule does not receive the attention it merits. In most text-books on surgery, even in some of the treatises on hernia, it is barely mentioned. Though uncommon, it is one of the most important forms of hernia, its importance lying in its recognition during operation. If unrecognized, proper operative steps cannot be instituted, and the viability of the bowel may be jeopardized.

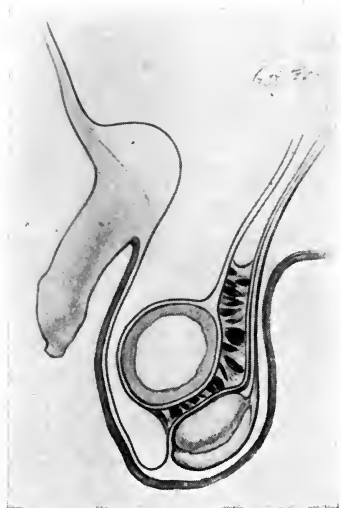
Since the first accurate description by Scarpa in 1812, it has been variously known as adherent hernia of the large intestine, hernia with incomplete sac or sliding hernia, the *hernie par glissement* of French authors. As I hope to show, the only proper designation is adherent hernia of the large intestine, the other terms being misnomers, based on faulty conception of pathogenesis.

The most widely accepted theory is that this form of hernia occurs by the sliding of the gut on the posterior peritoneum. Before going further it is essential to describe the appearance of the unreduced hernia in the opened sac. The contents of the sac are either cæcum and ascending colon in right hernias, or ileopelvic colon (commonly called sigmoid) in left hernias; very rarely the transverse colon. The sac, well formed and complete on its anterior aspect, is seemingly deficient behind, the bowel being tightly adherent to, and apparently incorporated in, the posterior wall of the sac; hence the designation, hernia with incomplete sac. Fig. 1 shows this condition in sagittal section, Fig. 2 in cross section. If the incision in the sac is carried through the internal ring into the abdominal cavity, it will be seen that the adhesions of the gut to the posterior surface of the sac are continuous with the mesosigmoid, or with the normal reflection of the

peritoneum from the bowel to the posterior abdominal wall. An attempt to reduce the bowel will be unsuccessful until it is separated from the posterior wall of the sac by sharp dissection or without reducing sac and gut together. Above all, it is noteworthy that the adhesions between gut and sac wall show no evidence of being inflammatory, but resemble what they really are, the usual adhesions of the large intestine to the posterior peritoneum (Fig. 7).

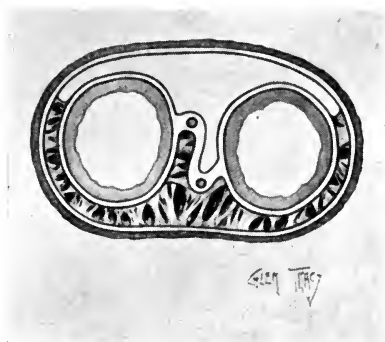
Pathogenesis.—In attempting to elucidate the various theories, I shall speak principally of adherent hernia of the sigmoid, as what pertains to hernias of the sigmoid on the left side may be applied to hernias of the cæcum on the right. I shall first consider the commonly accepted theory, that these hernias are due to the sliding of the posterior peritoneum on the underlying cellular tissue, the peritoneum sliding into the internal ring, carrying with it the attached loop of large bowel. This theory appears untenable, and rightly so, as it is based upon unsound mechanical principles. The iliopelvic colon or sigmoid is, in part, normally attached to the posterior peritoneum at the level of the left sacro-iliac synchondrosis, by a broad fold of peritoneum, which appears deficient on the posterior aspect of the gut. That is, the posterior surface of the bowel is apparently in direct contact with the retroperitoneal cellular tissue of the ileopelvic fossa. In a certain number of cases, however, the attachment of the ileopelvic colon lies at a lower level and the anterior leaf of its peritoneal covering is reflected to the anterior abdominal wall, just above Poupart's ligament, the posterior leaf to the posterior abdominal wall just above the internal ring. This brings the posterior uncovered surface of the bowel in direct contact with the internal ring, also uncovered by peritoneum, as its peritoneal covering has been dislocated to the anterior abdominal wall. Any sudden increase in intra-abdominal pressure or prolonged increase, as due to straining at stool, is sufficient to force the knuckle of bowel through the unprotected ring and into the canal. The continuance of pressure forces the gut, dragging the peritoneum behind it, further

FIG. 1.



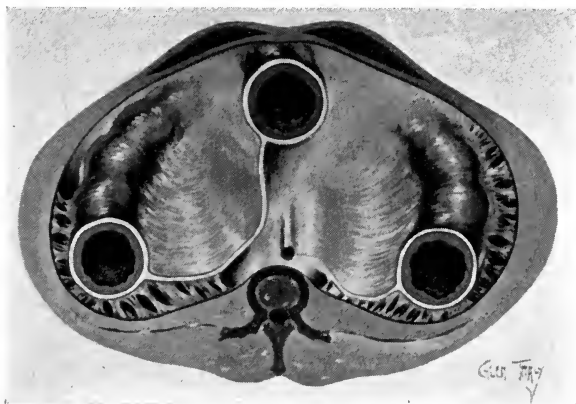
Sagittal section of adherent hernia of large intestine, showing adhesions between mesentery, gut and posterior wall of sac.

FIG. 2.



Cross section of large intestine, showing adhesions between mesentery, gut and sac wall, with nutrient vessels in the adherent mesentery.

FIG. 3.



Cross section through abdomen at third lumbar vertebra, looking toward diaphragm, showing mesentery of ascending and descending colon adherent to posterior abdominal wall.

FIG. 4.

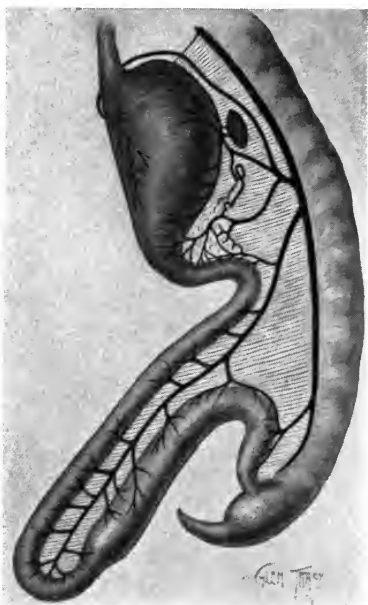


FIG. 5

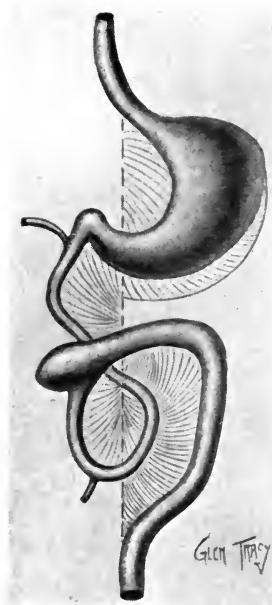
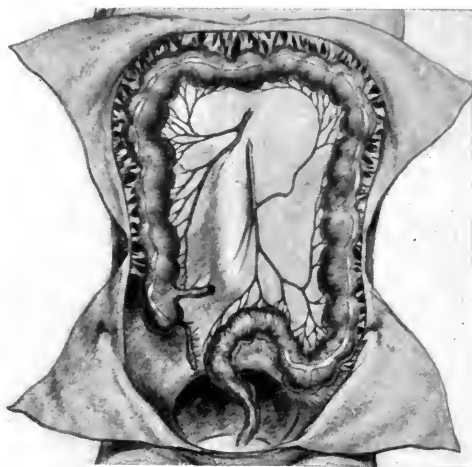


FIG. 4.—Alimentary tract of embryo of 6 weeks, showing rudiments of the two mesenteric systems (after Hertwig).

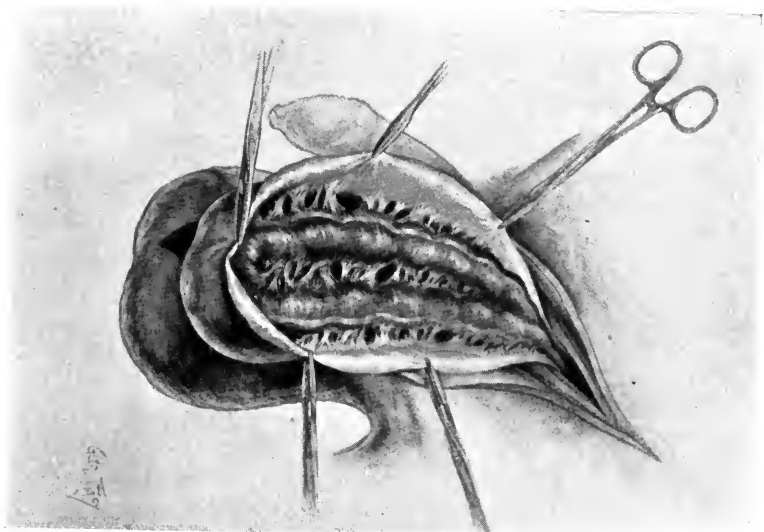
FIG. 5.—Embryo of 8 weeks, showing large intestine with free mesentery out-lining the abdomen.

FIG. 6.



Drawing from cadaver, showing the adherence of the entire ascending and descending colon, the adhesions beginning at the hepatic and splenic flexures.

FIG. 7.



Drawing from life, showing the sigmoid adherent in the opened sac.

FIG. 8.



Showing method of operating on adherent hernia of sigmoid; peritoneal flap prepared for closure of ring; purse-string and continuous suture for formation of new mesentery almost completed.



along the canal into the scrotum. This low position of the sigmoid is supposedly due to the downward dislocation of the peritoneum lining the lower portion of the abdomen. This dislocation is either congenital or has been caused by increased intra-abdominal pressure. It is presumed that the posterior peritoneum has become loosened from its underlying supporting cellular tissue. This theory, accepted by Ranzi, Scarpa, Wier, Stoney, and many others, is utterly fallacious. Even in the opened abdomen, it is no easy task to strip the peritoneum from the abdominal wall, so close is its adherence; in addition to this, any increase in intra-abdominal pressure only serves to apply the parietal peritoneum more closely to the abdominal wall.

If this form of hernia occurred by sliding of the peritoneum on the posterior abdominal wall, there would be a dislocation of the entire posterior peritoneum with the attached gut; whereas, the splenic flexure on the one hand, and the hepatic flexure on the other, are invariably found in their normal anatomical positions. It is true, that Tuffier has reported a case of enormous hernia of the descending colon, where the kidney was dislocated. This, however, was probably due to a dragging of the inferior mesenteric artery on the aorta and the dislocation of the aorta and through it a dislocation of the kidney. Again, if this form of hernia occurred by sliding, there would be from the moment of occurrence difficulty in reduction; whereas, in nearly all cases the history points to the hernia having become irreducible only after months or even years.

But most convincing of all are the few cases in which, without visceral transposition, the cæcum has been found adherent in left-sided hernias and the sigmoid in the right hernias. By the utmost stretch of imagination there can be no discussion on this point; the peritoneum on the left side cannot slide into the right inguinal canal, nor *vice versa*. Furthermore, it is almost axiomatic that the *sine qua non* of the development of a hernia of an intestinal coil is the mobility of that coil. If a loop of intestine is found fixed in

a hernial sac, it is conclusive proof that before the formation of the hernia the loop was mobile. The sigmoid does not rest on the cellular tissue of the posterior abdominal wall, but is separated from it by a triplicate layer of fused peritoneum. First the posterior peritoneum itself, second and third the double layer of adherent mesentery through which the nutrient vessels of the gut pass (Fig. 4). This same relationship exists between the sac wall and the adherent intestinal coil (Figs. 1 and 2). This fused peritoneum, called by the French the *fascia d'accolement*, fixes the attached portion of the sigmoid and cæcum firmly to the posterior abdominal wall, and itself prevents any possibility of sliding or dislocation.

An ingenious, though untenable, theory has been advanced by Lockwood, who claims that before the descent of the testes the right testicle lies in close relationship to the cæcum, the left to the sigmoid flexure. Lockwood supposes that an abnormal adhesion develops between the cæcum or sigmoid on the one hand and the right or left testicle on the other. The testicle in its passage downward through the internal ring pulls on the cæcum or sigmoid, as the case may be, and dislocates it downward to the region of the internal ring, where any slight increase in pressure is sufficient to force the gut into the inguinal canal. The untenability of this theory can be appreciated when it is realized that the extraperitoneal testicle is separated from the gut, not only by the parietal peritoneum, but also by the double fused layer of agglutinated mesocolon. In our many cases of retained testes, we have never encountered any such adhesion. It is just as impossible to picture an adhesion occurring between the kidney and intestine as between the testicle and intestine. However, even granting the possibility that this adhesion might occur, the disproportion in size between the testicle and colon would result not in a descent of the colon, but rather in a retained testicle.

Another theory almost too futile to deserve serious consideration has been advanced by Savariaud. He supposes

that the bowel slips out from its mesentery as a glove finger is everted, passes behind the peritoneum and so on into the ring. Considering that the true length of the colic mesentery, though adherent, extends from the vertebral column to the gut, this theory becomes immediately disqualified (Fig. 3).

It is evident that none of these hypotheses can adequately or satisfactorily explain the condition under consideration. In order to truly understand the pathogenesis of attached hernias of the large intestine, it is essential to consider the embryology of the intestinal tract, its mesenteries, and particularly the secondary changes in the mesentery of the large intestine.

During the fourth week of embryonic life, the alimentary tract stretches as a straight tube from primitive mouth to anus. All but the upper portion is attached behind to the chorda by a straight double mesentery, the layers of which enclose at the base the primitive aorta. The first differentiation of this tube into its separate parts begins with the development of a small spindle-shaped enlargement, the stomach. The rest of the alimentary tube is still connected with the yolk sac. The further alteration in the shape and position of the alimentary tube and its mesenteries is due to the disproportionate lengthening of the tube, that is, disproportionate to the development of the abdominal cavity. Consequently, to find room, the intestinal canal must take a winding and tortuous course.

The stomach is the first portion of the intestinal tract to begin its axial rotation, turning so that the left side becomes the anterior surface and lesser curvature, the right side the posterior surface and greater curvature. This brings the pylorus slightly to the right of the median line, and begins the twisting of the intestine. The twisting of the small intestine takes place about the origin of the superior mesenteric artery, and both it and the large intestine rotate in the direction opposite to that of the hands of a clock.

In an embryo of six weeks the intestinal tract, greatly increased in length, has already formed two distinct loops both running in an anteroposterior direction. In these loops

can be recognized the rudiments of the two mesenteric systems, the great or superior and the lesser or inferior (Fig. 4). From the pylorus the intestinal tube runs directly backward to the vertebral column; from here a sharp bend downward and forward toward the umbilicus; from the umbilicus back to the vertebral column and then straight on to the rectum. The upper loop consists of two nearly parallel arms connected to the vertebral column by a sagittal mesentery, in which runs the first evidence of the superior mesenteric artery. At the apex of the loop is the now occluded viteline duct. A little further toward the caudal end of the embryo is found a slight enlargement, the beginning of the large intestine. At this stage the lesser or inferior mesenteric system can also be distinguished near the caudal end of the embryo. During the third month further changes occur in the size and position of the stomach. As these changes, however, are not germane to the subject under consideration, it suffices to say that the twisting of the stomach and its mesentery results in the formation of the bursa omentalis. The changes in the small and large intestine, particularly the variations in the relation of their mesenteries, are of paramount importance to the comprehensive exposition of hernias of the large intestine. The duodenum is the only portion of the small intestine which retains its early embryonic position. It is attached to the vertebral column by a short mesentery, which early fuses with the parietal peritoneum, thus permanently fixing the duodenum in place.

The increase in length of small intestine is accommodated by the folding of its mesentery in a frill shape, the base narrow and the outer edge of great length. The most important change, however, takes place in the position of the large intestine and its mesentery. This fact must always be borne in mind; the large intestine at all times possesses a long mesentery and is at no stage or in no part extraperitoneal (Fig. 3). The cæcum is at this stage rotated across the abdomen from below upward and from right to left and again to the right, until it occupies a position under the liver.

This ascending loop, which later forms the entire large intestine, thus crosses the loop of small intestine from below upward and from right to left, crossing at the duodenum, carrying its mesentery with it. This explains why the duodenum is buried under the transverse mesocolon (Fig. 5). The cæcum, in the adult sense of the word, is not yet developed, as it is not an integral part of the embryonic large intestine, but a pouching or evagination of its wall. The transverse colon as in adult life crosses the duodenum to the splenic flexure and from there on the descending colon to the rectum. In later embryonic life the cæcum descends toward the right pelvis, forming the ascending colon.

This description has been undertaken to show that the entire large intestine has a distinct mesentery and lies free in the abdominal cavity. The large intestine forms a horse-shoe, outlining the confines of the peritoneal cavity. Grouped in the centre are the small intestines (Fig. 5). The secondary adhesions, which now form, change the mobile fetal large intestine into the fixed adult type.

Peritoneal surfaces have a tendency to adhere when they are held in contact under pressure. The small intestine, and particularly its mesentery, does not adhere to the parietal peritoneum, for two reasons: (1) from the time of the development of the liver in the fifth week, the small intestines are filled with its secretion, and in a state of active peristalsis; (2) its frilled mesentery presents no broad surface for agglutination.

The conditions in the large intestine and its mesentery are the reverse.

(1) The broad flat mesentery stretching on either side from the vertebral column to the large gut rests directly on the posterior parietal peritoneum (Fig. 4). Moreover as the large bowel is empty and not in active peristalsis, it is immobile.

(2) The mesentery is held in contact to the posterior parietal peritoneum not only by the pressure of the filled moving small intestines, but also by intra-abdominal pressure.

(3) Still another feature is the increase in local pressure at the site of the projecting kidneys and adrenals, which force the parietal peritoneum in direct contact with the ascending and descending colon.

The adhesion of mesentery always precedes the adhesion of the bowel; that is, the adhesions begin at the root of the mesenteries and spread toward bowel. Failure of the adhesions to be continuous results in the ileocæcal fossa on the right side, the parasigmoid on the left (Fig. 3).

The agglutination of the large intestine begins at the transverse mesocolon, which adheres to the great bursa. The transverse colon, however, retains its mobility by the mobility of the bursa itself. According to Browman, the limits of adherence of the ascending and descending colons depend entirely on the retroperitoneal position of the kidney and adrenals. Only those portions of the colon lying directly on the anterior surface of the kidney and adrenals adhere, which accounts for the comparative mobility of the cæcum and ileopelvic colon, both of which lie below the level of the kidney. This explanation of the mobility of the cæcum and pelvic colon, while very plausible, does not explain those cases in which the entire descending and ileopelvic colon is found adherent to the posterior peritoneal wall (Fig. 6). The theory, which seems more plausible, is that advanced by Lardennois, that the secondary adhesions of the large intestine begin at two points: on the right side at the hepatic flexure, at the entrance into the mesentery of the highest branch of the right colic branch of the superior mesenteric artery (Fig. 6); on the left side at the splenic flexure, where the highest branch of the inferior mesenteric artery first enters the descending mesocolon, this adhesion being continuous with the phrenocolic ligament. It is interesting to state here that no matter how great the ptosis or dislocation of the colon, the hepatic and splenic flexures are invariably found in their fixed positions. Beginning at the hepatic flexure on the right side the mesentery of the ascending colon adheres along its entire length, the adhesions increasing in extent as

the head of the colon descends. The adhesions begin at the inner border of the mesentery and spread toward the periphery. The cæcum being a pouching of the head of the large bowel has no mesentery and, therefore, does not adhere. The extent of mobility of the cæcum depends entirely on its length; a short cæcum being only slightly mobile will never be found in a hernial sac, while a long, freely movable cæcum has almost the same opportunity of entering the hernial sac as a coil of small intestine. This comparative mobility of the cæcum is often observed during operation in the appendix region. Every operator realizes how simple it is in some cases to deliver the cæcum through a gridiron incision and how difficult in others. The adhesion of the descending colon begins at the splenic flexure and passes progressively downward along the whole course of the posterior abdominal wall to the brim of the pelvis.

It is necessary at this point to consider the measurements of the different parts of the colon. The left colon is arbitrarily divided into the descending and ileopelvic portions. The length of the descending colon is fairly constant, measuring about 14 cm. The ileopelvic portion on the other hand varies within the enormous limits of 14–81 cm. Evidently the longer the colon the greater will be its motility, as only that portion will adhere which comes into direct contact with the posterior peritoneum. An extremely long ileopelvic colon partakes of the nature of the small intestine, and for this reason has the same chance of entering the hernial sac. A short colon stretched from the splenic flexure to the rectum would be adherent along its entire length (Fig. 6), and this brings out the crucial point, it could not possibly become engaged in a hernia.

What is the cause of the adherence of the large intestine, when it finally gains access to the hernial sac? Its early reducibility is sufficient proof, that in the beginning it is non-adherent. The reason for its adherence is that under resumed embryonal conditions it follows its embryonal tendencies. In the hernial sac, the broad flat mesentery of the large intestine

comes into direct contact with the peritoneal surface of the sac. Moreover, the two peritoneal surfaces are held in contact under considerable pressure, as the large intestine, particularly by pelvic colon, is usually distended with fæces. Beside, the large intestine, unlike the small intestine, is comparatively immobile and seldom in a state of active peristalsis. Thus we have the requisites for peritoneal agglutination present: (1) broad flat surfaces held in contact under pressure; (2) comparative immobility.

As in embryonic life, the adhesions begin behind, at the attachment of the mesentery, and progress steadily around the sac (Figs. 1, 2, and 7). There are cases reported of so-called hernias without sacs, where the entire sac has been obliterated by these adhesions.

To recapitulate: After studying the embryology of the large intestine and the secondary adhesions of its mesenteries, the following conclusions may safely be drawn:

1. So-called hernias with incomplete sacs do not exist, except as a secondary process.
2. The sac is complete in its incipency and has been obliterated by secondary adhesions of the embryonal type.
3. A loop of intestine found in a hernial sac is conclusive proof that originally that loop was mobile.
4. In adherent hernias of the large intestine the hernia is primary, the adhesions secondary.
5. The crux of the situation is the redundant colonic loop.

Morphologically, three forms of hernia of the large intestine may be distinguished, the varieties based on the relationship of contents to sac:

1. The sac is complete. That is, there are no adhesions between the sac wall and gut. This form differs in no wise from the ordinary reducible hernias of the small intestine. The loop of the bowel and its mesentery are easily reduced. This form of hernia occurs when from an early stage in its existence the hernia has been kept in place by a truss, and no chance has been given for the formation of adhesions.
2. The most common form of hernia of the large intestine

is that with partial obliteration of the sac by secondary adhesions, the so-called hernia with incomplete sac (Figs. 1, 2, and 7). The posterior portion of the sac has become obliterated by adhesions beginning at the mesentery behind and extending to a variable distance around the sac. The entire loop of bowel is usually found adherent, beginning below at the base of the sac and extending to the neck. When the cæcum and appendix are engaged in a hernia, the adhesion begins at the broad flat mesentery of the head of the colon and the first loop of the ileum.

3. Hernia with complete obliteration of the sac, the so-called sacless hernia, is extremely rare and very few cases have been reported. There is some doubt whether this form of hernia really exists, and whether some portion of the sac, however small, is not always preserved.

These adherent hernias of the large intestine are seldom strangulated, probably due to the large size of the ring, which has been enlarged by the thick-walled large bowel and its semi-solid contents. On the other hand, inflammation and the presence of fibrinous exudates in the sac are not of unusual occurrence, as in Case I. This is perhaps due to an injury of the irreducible gut, and the migration through its wall of bacteria.

On opening the sac by a hernia-laparotomy incision, it is found that the adhesions of the gut to the posterior surface of the sac are continuous with the mesosigmoid, or with the normal reflexion of the peritoneum to the posterior abdominal wall. The gut is continuous with the pelvic colon or with the ascending colon as the case may be. The adhesions are so dense that it seems as though the sac is really deficient behind. What is most important is the fact that the nutrient vessels of the bowel are found in the adhesions. An attempt to separate these adhesions by blunt dissection is unsuccessful. The anterior part of the sac is free, the posterior wall is formed by the loop of gut, which seems to be really incorporated in the wall of the sac, the peritoneum of the sac appearing to be continuous with the covering of the bowel (Fig. 7). There

are frequently other contents of these hernial sacs. On the right side the first coil of ileum with its mesentery may be found adherent in the sac, on the right or left side free coils of small intestine. Unless strangulated, the small bowel is easily reduced, leaving the hernial sac with the large bowel attached to its wall. In some instances the adhesions may be so dense as to include the extraperitoneal testicle and cord. Cases have been reported in which the testicle was so adherent that it was necessary to sacrifice it before radically curing the hernia. This, however, seems in the majority of cases unjustifiable.

Symptomatology.—Though the symptoms of these hernias are not in any way distinctive, there are certain suggestive features which point to the possibility of a diagnosis being made. Usually occurring in males, these hernias come on after adult life. At first reducible, they become irreducible after months or sometimes years. If sigmoid hernias, they have a doughy feeling and cause their bearer less discomfort after a thorough evacuation of the bowels. If a hernia of this sort is suspected, the diagnosis could easily be made by the injection of bismuth per rectum, followed by a radiogram. It is during operation that the diagnosis can and must be made, as only by precisely understanding the condition present can proper treatment be instituted. After exposure and isolation of the sac in a radical herniotomy, it is the practice of many surgeons to attempt to reduce the contents before opening the sac. If this manœuvre is unsuccessful, an immediate suspicion of adherent hernia should be aroused, and the greatest precautions taken to obviate injury to the bowel. The sac should be palpated with the gloved finger and a non-adherent portion found, which is invariably in the anterior portion of the sac. Grasping this non-adherent portion of the sac with forceps, it is lifted free from the underlying contents and opened by a small incision. The opening is enlarged upward toward the neck of the sac preceding the incision, with the finger or grooved director. In extending the opening of the sac downward, it is well to exert great care not to injure the cross loop of the bowel. After freely opening the sac.

if this form of hernia is borne in mind, the diagnosis can surely be made. If a gentle attempt is made to separate these adhesions, it will be found unsuccessful without using undue force. In fact any attempt to separate these adhesions is unjustifiable and may result in disaster.

Treatment.—According to Weir, Heydenreich attempted this manœuvre in two cases, both followed by fecal fistula and recurrence of the hernia. Numerous like disasters have been reported. Fearing a similar result, Jaboulay resected the entire adherent loop of bowel.

No matter what method of treatment is followed, it is essential that the neck of the sac should be well exposed. To accomplish this exposure, it is frequently necessary to perform a hernia-laparotomy. This is done by introducing the finger through the internal ring and cutting the internal oblique to a variable extent above the ring. After this is done, one of several methods of treatment may be instituted. Savariaud's method is in fact a reduction of the sac and bowel *en masse*. This method was practised in Cases I and II. In order to thoroughly complete this operation, the sac and its contents must be well exposed above the internal ring, which must be stretched sufficiently wide to permit the passage of the sac and its contents without using undue force. In his original description of the operation, Savariaud advised the closure of the incision in the sac wall before reduction is attempted. The sac and its contents are then forced through the internal ring as though inverting a gloved finger. The ring is closed by bringing the edges of the inverted sac in apposition by interrupted sutures. The operation is completed as an ordinary herniotomy.

The disadvantages of this operation are the insecurity of the closure of the ring and the danger which always attends the reduction of a hernia *en masse*. That is, there is a possibility of later strangulation within the reduced sac. The operative procedure followed in Case III, which is a slight modification of a method described by Hotchkiss in 1910, seems to offer greater advantages in that it results in a return

to fairly normal anatomical relations. After division and thorough exposure of the sac (Fig. 7) it will, as a rule, be seen that one side of the sac is of greater width than the other. In this event the more ample peritoneal surface is chosen as a flap to cover the ring. In case the peritoneal surfaces are of almost equal extent the mesial portion of the sac should be utilized for this purpose.

The portion of the sac chosen as a covering for the ring is separated by an incision beginning at the bottom of the sac and running parallel to and at least one inch from the gut wall. The flap is completely freed below, left attached above to the peritoneum covering the internal aspect of the ring (Fig. 8). The loop of bowel is now pulled out well through the ring and reflected on the abdomen. The attached flaps of the sac are now united on the posterior surface of the bowel by a fine running catgut suture, thus forming a new mesocolon. The suture is begun above at the cross loop of the bowel by using a wide purse-string suture so as to prevent angulation. After the continuous suture is completed, the loop of bowel is easily reduced. The ring is closed by suturing the prepared flap of peritoneum to the peritoneum covering the internal ring. The margins of the internal oblique, if divided, are exactly approximated, and the operation completed after the Bassini method. Lardonnois and Okinji suggested that as these hernias are due to the mobility of the large intestine, they should be treated by fixing the intestine to the posterior peritoneal wall. After exposing the sac, the neck is well exposed by a hernia-laparotomy and the gut carefully dissected from the sac. The loop of large intestine is then sutured as high as possible to the posterior peritoneal wall as in colopexy. In extreme cases it might be well to combine this procedure with the method of operation described above. In a class of cases presenting so many difficulties, probably no one method of treatment will be applicable to all cases, and a combination of two methods may occasionally be of advantage.

The following cases are from the records of Dr. Joseph Ransohoff and the writer:

CASE I.—U. L., aged fifty-four, complained of left inguinal hernia, which had been present for many years, but had only become irreducible during past two years. Examination revealed a left irreducible inguinal hernia, the size of an orange.

Operation (Jewish Hospital, March 7, 1908).—Gas-ether anæsthesia. After opening the sac the descending colon was found adherent to its posterior wall. The gut and sac were reduced *en masse*, and the ring closed by suture. The operation was completed as a typical Bassini. The recovery was uncomplicated and there has been no recurrence.

CASE II.—A. L., aged fifty-three, had had a hernia for two years, which became irreducible during the last two months. During past two days the hernia was swollen, tender and painful. Examination revealed a tense irreducible left inguinal hernia, the size of two fists.

Operation (Jewish Hospital, May 13, 1909).—Gas-ether anæsthesia. After exposing the sac in the usual way, incision into it revealed the inflamed and thickened sigmoid loop adherent to the posterior wall of the sac. Gut and sac were reduced *en masse* and the ring closed by the suture of the inverted sac wall. The operation was completed as a typical Bassini. Recovery was uneventful, and there has been no recurrence.

CASE III.—D. B., aged fifty-nine, had an irreducible inguinal hernia, which had been present for twenty years. During past three years hernia had become irreducible. Examination revealed a very corpulent man with a large, irreducible, left inguinal hernia.

Operation (Jewish Hospital, July 29, 1911).—Gas-oxygen-ether anæsthesia. After exposing the sac in the usual way, an attempt to reduce its contents before opening was unsuccessful. On opening the anterior part of the sac, a loop of the sigmoid about ten inches long was found adherent to its posterior wall. The neck of the sac was exposed by incising the internal oblique. A peritoneal flap for the closure of the ring was made as described above. The two attached portions of the sac were united over the posterior surface of the gut by a running catgut suture. The gut with its new formed mesentery was easily reduced and the ring closed by suturing the prepared flap to the margins of the ring by interrupted catgut sutures. After carefully approximating the cut margins of the internal oblique, the operation was completed as a typical Bassini. Recovery was uneventful, and there has been no recurrence.

AN APPARATUS FOR INTRATRACHEAL INSUFFLATION.

(From the Laboratory for Surgical Research, Columbia University.)

BY HENRY H. JANEWAY, M.D.,
OF NEW YORK CITY.

THE accompanying photographs represent an apparatus for the administration of anæsthesia by intratracheal insufflation. It embodies a number of ideas applied to intratracheal insufflation which have been the outgrowth of the previous work of Dr. Nathan Green and the writer in experimental intrathoracic surgery.

The apparatus furnishes to the patient a continuous current of warmed, moistened, and filtered air, mixed with any desired amount of ether vapor, and interrupted at regular intervals, in order to allow at such intervals of partial collapse of the lungs. At the present time the advantages of such a method of anæsthetization by intratracheal insufflation are abundantly substantiated. The apparatus is easily portable, measures only 18" \times 8" and will run upon both the alternating and direct current.

The current of air is supplied by the rotary blower "1." This blower is of the simplest type and is in no way dependent upon the use of springs. From the blower the air passes through the filter "2" and from here through the valve "3" over the surface of the ether in the jar "4." After passing over the surface of the ether the current of air passes over the surface of the heated water in the jar "5." The water in this jar is kept at a constant temperature by an electric heater inside. By means of the valve "3" any proportion of the air current may be shunted directly over the heated water in jar "5," thus diminishing reciprocally the amount which passes over the surface of the ether, and in this manner the

FIG. 1.

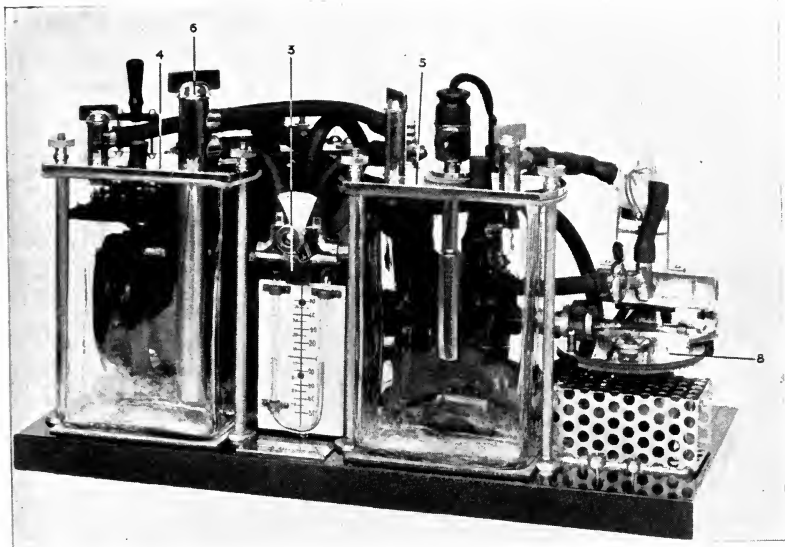


FIG. 2.

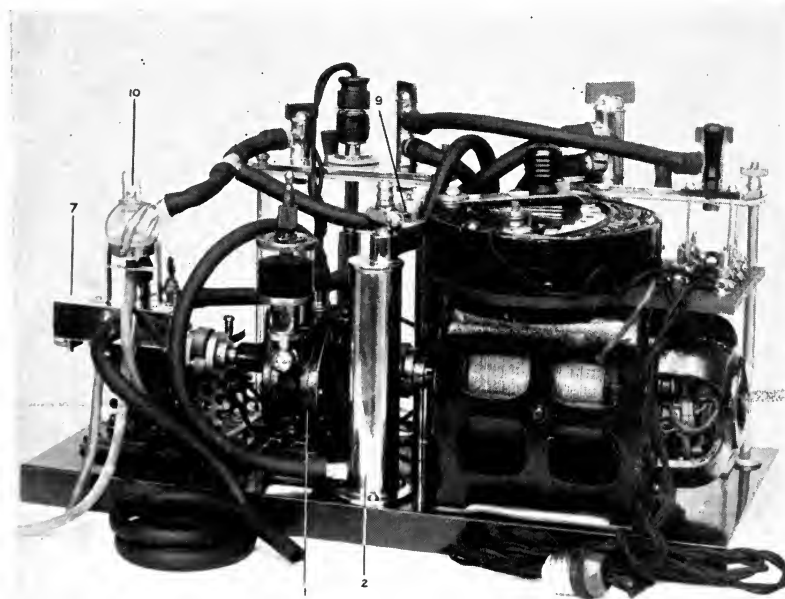
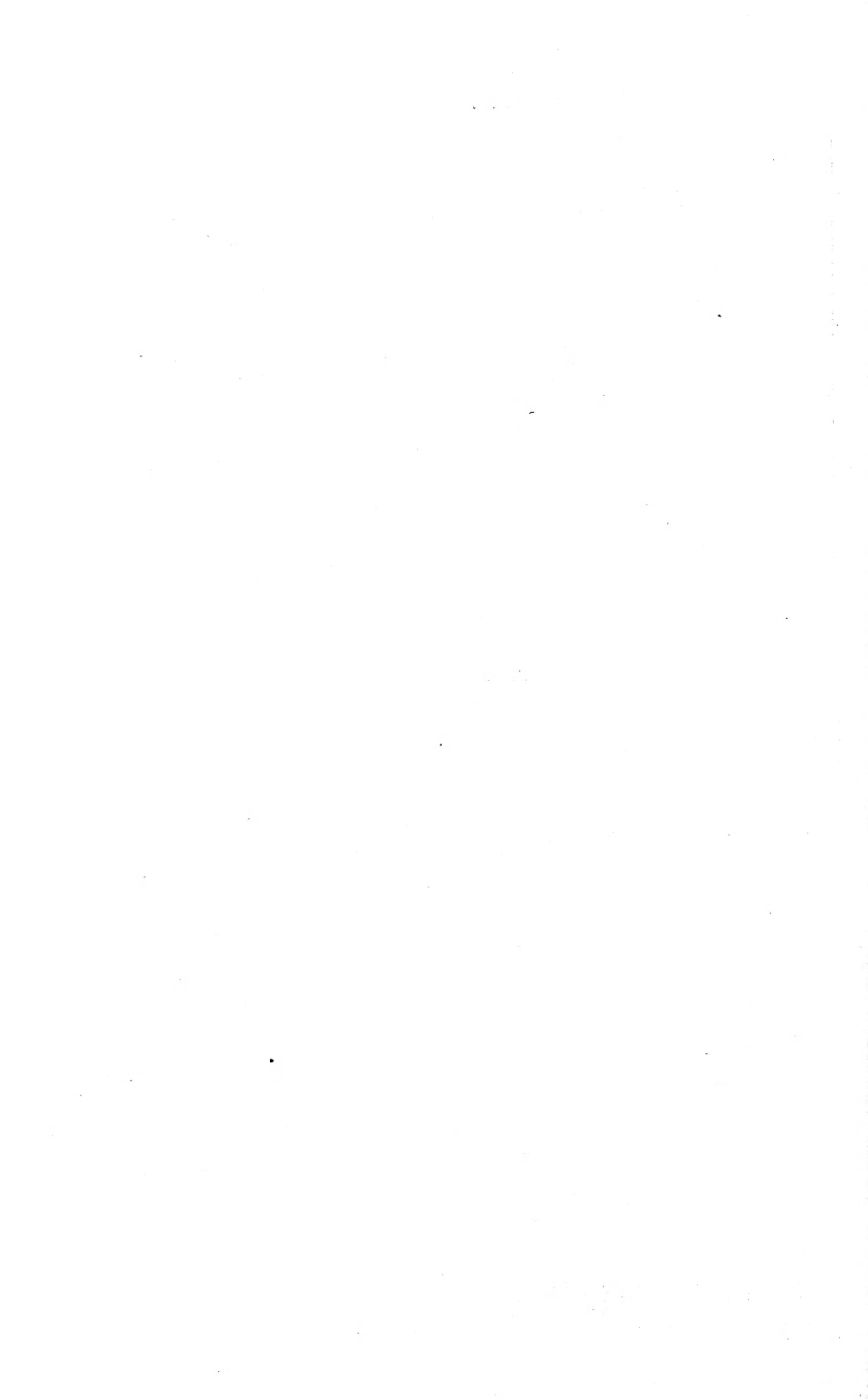


FIG. 1.—Front view. 3, valve for regulating the amount of air passed over the surface of the ether; 4, ether jar; 5, water jar; 6, valve for bubbling a portion of the air through the top layers of the ether; 8, worm wheel operating interrupting valve.

FIG. 2.—Back view. 1, blower; 2, air filter and muffler; 7, interrupting valve; 9, safety-valve controlling the pressure; 10, condensing bulb.



amount of ether supplied to the patient. In case a greater quantity of ether is desired at any time, provision is also made by the valve "6" for bubbling a proportion of the air passing through the ether jar through the top layers of the ether irrespective of the level of the ether in the jar.

The current of air passing to the patient is interrupted at regular intervals (which can be varied) by the valve "7," operated in turn by the worm wheel "8." These interruptions are a very important part of intratracheal insufflation. Not only do they materially aid the diffusion of oxygen to the alveoli of the lungs, but they also bear a direct relation to character of the circulation by facilitating the return of the venous blood to the heart. A positive pressure maintained by a constantly distended lung around the great veins entering the heart impedes the venous flow to the heart, and, if high enough, can actually create a mechanically caused shock. For this reason as well as for safe-guarding against rupture of the lungs, the proper regulation of the pressure in intratracheal insufflation is very necessary. An accidental momentary increase of the pressure during intratracheal insufflation may cause rupture of the lungs and fatal pneumothorax with emphysema. With a medium sized catheter within the trachea and a free outlet of the air through the larynx it is difficult to realize how a pressure within the trachea sufficiently high to rupture the lungs could ever occur.

During such acts as coughing the intrapleural pressures often reach 80 to 116 mm. of mercury. The elastic recoil of the lungs after death has been estimated by Hutchinson at 4.23 mm.Hg. To overcome this pressure it is only necessary to supply air through the usual intratracheal catheter at a pressure of 20 mm. of Hg. At this pressure the intratracheal pressure is about 5 mm. of Hg. Even without a manometer to guide one, and much less with one, at first it had been considered safe to trust alone to the degree of distention of the lungs as a guide to the amount of air to be supplied to the patient. Experience, however, has proved this not to be so. Sudden accidental rises in the pressure

may occur. If the tube has not been introduced within the trachea carefully under the guide of direct vision, the latter may be so irritated that it will tightly close around the catheter, causing a sudden increase of pressure. In our own experience a death has resulted from the anaesthetist's pushing the intratracheal tube so far within the trachea that its distal end entered one bronchus. The bronchus tightly hugged the tube, with the result that all the air was blown into one lung with no way of escape. The lung was ruptured, and fatal pneumothorax and emphysema resulted. Such experiences as these demonstrate the necessity not only of carefully supervising the pressure by a manometer, but also the adoption of some means of providing automatically guarding against too great an increase of pressure.

Since the above mentioned experience we have added the blow-off valve "9" which can be adjusted to blow off at 20 or 25 mm. of Hg. The bulb "10" removes the water of condensation from the efferent current of air while the efferent tubes are becoming warmed. We have also added recently a pressure reducer to the blower which permits of the use of very small quantities of air and consequently the saving of ether without the hissing noise incidental to the blow-off valve. Its utilization is of service when ether is given by intratracheal insufflation in other cases than thoracic ones. While intratracheal insufflation may be given with a very simple apparatus depending upon a hand or foot bellows for the supply of air, we believe that the facilities and safeguards of the apparatus herein described insure greater ease and security of administration. A foot bellows should always be at hand in case of accident to the electric current. Such a bellows can be attached to the supply pipe from the blower in time of need.

PICRIC ACID AS A SKIN DISINFECTANT.

BY O. W. H. MITCHELL, M.D.,

OF COLUMBIA, MO.

(From the Pathological Laboratory, University of Missouri.)

IN the ANNALS OF SURGERY, August, 1911, a report was made from this laboratory upon the germicidal and osmotic properties of picric acid. At that time, picric acid solutions had been used in 19 cases in the service of Dr. F. G. Nifong at the Parker Memorial Hospital. The laboratory tests were so pleasing that the action of picric acid as a disinfectant for the skin seemed promising.

Up to the present time the picric acid solutions, in the main 1 per cent. alcoholic solutions, have been used in 78 cases. Commenting upon its use, Dr. Nifong writes me as follows: "During the last year I have used it in practically all of my cases. When a patient can be prepared over night he has the usual shaving and soap and water scrub, with a saturated watery solution of picric acid applied over the field. Before operation he is washed again with soap and water and the alcoholic solution is applied. In cleansing a scalp or sterilizing an infected wound I have found it most efficient and reliable, which is no doubt due to its high germicidal action and its great power of penetrability, as you have shown by your experiments. I have had no case of wound infection since I have used the method. The only objections I have to it is the intense and tenacious staining, and on two occasions when I did not have my wound edges perfectly coapted there were one or two small points of delayed union due to small coagula of serum between the edges of the wound. These coagula were cultured and found to be absolutely sterile. This high power of coagulating serum makes it necessary to make close and perfect approximation of wounds and leave no

pocket of serum which will be coagulated with a very small quantity of the picric acid and hinder union mechanically."

Shortly after the publication of the uses that have been made of the picric acid solutions here, Fontana ¹ published his results. The review appearing in the *Journal of the American Medical Association* ² is as follows: Fontana uses a 1 per cent. alcoholic solution of picric acid for sterilization of the field of operation, and extols its advantages over other methods. It is as effectual, his tests seem to show, as the tincture of iodine method, while it is much more convenient for sterilization of the hands. Both of these do away with the long scrubbing indispensable with other technics, and which is so liable to chill the patient.

The solutions of picric acid can be depended upon as germicidal and are to be recommended for skin disinfection because of this property and the one of penetrability. Picric acid is cheap and efficient, and deserves a prominent place among the substances used for disinfecting the skin before surgical intervention.

¹ *Riforma Medica*, xxvii, No. 35, pp. 953-980.

² *Journal A. M. A.*, lvii, 19, Oct. 17, 1911, p. 1249.

TRANSACTIONS

OF THE

AMERICAN SURGICAL ASSOCIATION.

Annual Meeting held at Montreal, Canada, May 29, 30, 31, 1912.

The President, ARPAD G. GERSTER, in the Chair.

ADDRESS OF THE PRESIDENT.

NEPHRECTOMY.

THE President, ARPAD G. GERSTER, M.D., of New York, delivered the opening address, on the above subject, for which see page 1.

BLOODLESS OPERATIONS ON THE LIVER.

JOHN R. McDILL, of Manila, P. I., reported the results of an experimental study of the possibility of excision of maximum amounts of liver tissue, with the usual instruments at hand in any hospital. His method is as follows:

An enterostomy clamp armed with rubber tubing is passed through a one-inch incision just below the ribs in the mid-axillary line into the abdomen; one blade is introduced into the foramen of Winslow about two inches; when the clamp is closed the circulation in the liver can be turned on or off completely or partially as desired.

For the support of the parts after resections of large wedges of liver tissue, a Martin gum bandage passed entirely around the liver is proposed.

The experiments on dogs show that 20 to 30 minutes' complete interruption of circulation is not followed by bad results, and it is thought that in clinical work the circulation can be completely interrupted with safety for from eight to ten minutes. More experimental work, however, will be required to determine the limits of this procedure.

Conclusions.—I. Extensive liver resection for disease is lim-

ited to primary, single, or closely grouped, accessible conditions; size may be no contraindication, unless too near the portal vein or hepatic arteries. In all primary growths observe Tuffier's caution carefully to determine glandular involvement along the vessels at the base of the liver.

2. All procedures can probably with safety be made entirely bloodless for at least eight or ten minutes; by opening and closing the forceps the circulation can be turned partially or entirely on or off to avoid the danger of a too prolonged interruption; this controlled blood stream also favors hæmostasis by slowly filling up cut vessels and stitch wounds with coagula; compresses to cut or wounded surfaces during a re-establishment of circulation would prevent undue loss of blood and allow of ligation or circum-stitching of venous channels.

3. Great congestion of the gastro-intestinal branches of the portal system, blueness of the intestines, and subperitoneal ecchymoses while using the clamp indicate a dangerous degree of back pressure. The shorter the time of complete temporary arrest of circulation, the better.

4. The variability of the liver tissue and of degrees of portal pressure should be remembered; a marked chronic portal congestion should contraindicate extensive operations.

5. Traumatic rupture of the liver frequently occurs without any external evidence; owing to structural arrangement, tearing of large vessels may result in continuous hemorrhage which is partially checked by reflex muscular rigidity and intra-abdominal tension; relief of this pressure upon opening an abdomen allows of increased bleeding unless immediate digital compression of the hepatic vessels is effected.

6. In favorable cases liver tissue can be removed to the physiologic limit under practically bloodless conditions.

7. Chloroform is always contraindicated in liver operations on account of the danger of sudden fatty degeneration and of necrosis and hemorrhage, due to the elimination of fibrinogen by the chloroform and inefficient coagulation; because fibrinogen is either formed wholly in the liver or is wholly dependent upon liver activity for its production.

8. The clamp can be left *in situ*, open, to control a possible secondary hemorrhage.

9. The instruments required for any liver surgery are in the usual hospital armamentarium.

LEONARD FREEMAN, of Denver, Col., said that he had found one of the most reliable and simple methods of preventing hemorrhage in resection of the liver to be the use of strips of gauze, made from the ordinary small folded tapes of gauze found in every operating room. A pair of narrow forceps of sufficient length to reach through the liver substance are plunged through the substance of the liver at the margin of the portion to be removed, seize two pieces of gauze and drag them through the hole in the liver; this procedure is repeated until the portion of liver to be removed is completely surrounded by gauze loops. The portion of each loop which lies beneath the liver substance has been cut in two and united with catgut in order to facilitate its removal. When these loops are tied down, not too tightly, the hemorrhage is completely controlled, and the portion of liver can be cut away like a piece of cheese. Another method employed in resecting large portions of the liver for multiple tumors is by the use of two wires forming a wire clamp; this method is particularly applicable to where a more or less detached portion of liver is to be removed. The wires should be stiff and long enough when placed on each side of the tongue or tissue that their edges may project from the abdominal wound, and they can be bent in a gradual curve if necessary. In employing this method three or more catgut loops are dragged through the liver by means of a small pair of alligator forceps, which seize the loops so that the free ends are all on one side; then one of the wires is inserted through the loops upon one side and the ends of the loop are tied over another wire on the other side, the wires then being brought firmly together, clamping the liver substance. At the end of a number of days the wires may be withdrawn, leaving the catgut loops in place to dissolve at will. This wire clamp has an advantage over the forceps clamp in that it does not crush the liver substance, the wires can be bent to conform to any sort of case, and the wire clamp cannot slip from the liver substance as the loops passing through the liver hold it firmly in place.

ACUTE PANCREATITIS, WITH EXTENSIVE FAT NECROSIS.

LUCIUS W. HOTCHKISS, of New York, read a paper with the above title, for which see page III.

JOSEPH RANSOHOFF, of Cincinnati, had had several cases of acute pancreatitis in his own practice and had seen several

others in consultation, but in no one of these had the diagnosis been made before operation. He cited an interesting case of acute pancreatitis following a simple operation for the removal of the semilunar cartilage of the knee in an apparently healthy young man of 18. The result was fatal.

MAURICE H. RICHARDSON, of Boston, said that he had never had any success in operating on cases of acute pancreatitis, that all his recoveries had occurred in cases which had been left to nature. He believes that operative interference in a suppurative condition involving the entire pancreas is almost certain to bring about a fatal result.

JOHN B. DEAVER, of Philadelphia, stated that internists frequently confused a condition of pancreatitis with effusion with that of pleuritic effusion, but in his opinion acute pancreatitis should always be considered when there was a history of sudden illness accompanied by acute epigastric tenderness and rigidity.

FRED B. LUND, of Boston, reported two cases of acute pancreatitis operated upon successfully.

CHARLES A. PORTER, of Boston, referred to two cases of acute pancreatitis. In one a diagnosis of acute intestinal obstruction had been made, but a condition of acute hemorrhagic pancreatitis found; in this case an incision was made along the pancreas, a large amount of the viscus sloughed, but the patient eventually recovered. Because of persistent right-sided pain, however, a second operation was performed, when a putty-like accumulation was removed from the head of the pancreas; the patient later developed diabetes; he has been under observation for about five years. In the other case the condition of acute pancreatitis developed four days after a forceps delivery under ether; when the abdomen was opened an acute fat necrosis was found, and the woman died two days later.

ROBERT G. LE CONTE, of Philadelphia, stated that there had been two cases of acute pancreatitis with fat necrosis followed by recovery after operation at the Pennsylvania Hospital.

HENRY B. DELATOUR, of Brooklyn, reported a case very similar to that of the author, in a patient of thirty-two whom he saw on the fifth day after onset of symptoms; there was a decided bulging just above and to the left of the umbilicus; a median incision was made, and there being evidence of fat necrosis, on examination the cavity was found to extend back

to the stomach. The anterior wound was lightly packed and a posterior left lumbar incision made, permitting the evacuation of about a quart of thin purulent material. This wound was packed with zinc oxide gauze and a rubber drainage tube inserted. On the fifth day following operation there was a discharge of the contents of the stomach through the drainage tube, anterior drainage having been removed at the end of the fourth day. The patient recovered.

GEORGE WOOLSEY, of New York City, considered the essential feature in the treatment of these cases to be the drainage, saying that he never touches the pancreas and has had no trouble in any of his cases in obtaining a good result. He simply institutes drainage.

FREDERIC KAMMERER, of New York City, reported two cases of acute pancreatitis occurring in his practice during the last few months.

ROBERT B. GREENOUGH, of Boston, referred to two cases of mild pancreatitis occurring in his practice during the past winter, which recovered without operative interference. In both there were symptoms of intestinal obstruction high up. In one, Dr. Pratt made examinations of the urine and found acetone and diacetic acid, and also diastase, and he considered this satisfactory evidence of a condition of pancreatitis.

EMMET RIXFORD, of San Francisco, mentioned a case of pancreatitis in which the fat necrosis surrounded the mesenteric vein, causing complete obstruction of the same, the patient dying of congestion.

SAMUEL J. MIXTER, of Boston, cited a case showing how quickly fat necrosis may develop after the opening of the abdominal cavity when no evidence is discernible of this condition at the time of operation. In his experience the cases which recovered had usually been those in which the least amount of surgery was done, and he advocated the simple drainage by gauze.

N. B. CARSON, of St. Louis, mentioned the difficulty before operation of differentiating some cases of cholecystitis from those of acute pancreatitis, and referred to a case previously reported by him, in which a diagnosis of gall-stones was made but which on exploration proved to be a condition of pancreatitis; drainage was instituted and the patient made a good recovery.

HOWARD LILIENTHAL, of New York, referred to six cases of

acute pancreatitis operated upon by him with five recoveries. He thought that it was important to take into consideration the grade of the infection and the bacteriology of it, as well as the extent of the enlargement of the pancreas.

EDWARD MARTIN, of Philadelphia, spoke of five cases of acute pancreatitis, in each of which the diagnosis was made by the medical attendant; three of these cases occurred in the practice of the late Dr. John H. Musser.

ARPAD G. GERSTER, of New York City, considered drainage the only salvation in cases of acute pancreatitis, and particularly recommended posterior drainage as being more in conformity with the law of gravity than is anterior drainage. He referred to several successful results from this method.

LUCIUS W. HOTCHKISS, of New York City, considered drainage by both the anterior and the posterior routes to be more effective than either one used alone.

TALMA OPERATION FOR CIRRHOSIS OF THE LIVER.

EDGAR A. VANDER VEER, of Albany, read a paper with this title.

OBSERVATIONS ON TUBERCULOSIS OF THE BLADDER, URETER AND KIDNEY.

ARCHIBALD MACLAREN, of St. Paul, read this paper, for which see page 134.

SURGICAL DISEASES OF THE ABDOMEN AND UTERUS COM- PLICATING PREGNANCY.

MAURICE H. RICHARDSON, of Boston, Mass., read a paper with the above title, which will be published in full in a later issue of the ANNALS OF SURGERY.

HEMORRHAGE INTO THE PERITONEAL CAVITY CAUSED BY ACCIDENTAL RUPTURE OF THE OVARY.

ALEXANDER PRIMROSE, of Toronto, Canada, read a paper with the above title, for which see page 125.

JOSEPH C. BLOODGOOD, of Baltimore, said that some years ago he reported two cases of clinically acute appendicitis, in one of which was found free blood in the peritoneal cavity

coming from the right ovary; hemorrhage was not excessive, nothing was done to the appendix, and the patient recovered. In the second case the hemorrhage was found coming from the fimbriated end of the Fallopian tube, the operation taking place during menstruation. In neither case was there any clinical suggestion of hemorrhage. Following this experience the speaker stated that he went over the histories of a number of cases and found that in the case of men he had never seen, or never recorded, hemorrhage in the peritoneal exudate. Up to the present time he had records of six cases of early appendicitis in women, some during the menstrual period, some in the interval, with considerable hemorrhage in the peritoneal cavity, but never to the degree reported by Dr. Primrose. In many cases the hemorrhage was but slight and there was no indication for the removal of ovary or tube.

HOWARD LILIENTHAL, of New York City, reported the case of a woman of 32, married two months, who had menstruated for the last time six weeks before he saw her, and then after an indiscretion in diet she vomited and became very faint. In a few hours another attack of faintness came on, followed by others at short intervals; she had all the symptoms of hemorrhage. Incision revealed a fibroid as large as a cocoanut attached to a pregnant uterus, and the peritoneal cavity full of blood. The fibroid was removed and the uterus sutured; the site from which the hemorrhage came could not be discovered. The patient made a good recovery, and there had been no miscarriage at the time of this report, three weeks after operation.

ARCHIBALD MACLAREN, of St. Paul, took exception to the usual idea that a certain time must elapse before a diagnosis of pregnancy can be made, believing that with fair probability it could be easily diagnosed at the first missed menstrual period. He thoroughly agreed with Dr. Richardson in his position regarding operations during pregnancy, and reported several instances where operative interference being necessary because of ovarian tumors, fibroid growths, and the freeing of a ventral fixation, it resulted in no interruption to the course of pregnancy.

LEWIS S. MCMURTRY, of Louisville, suggested that there was a possibility, in the cases reported, of the condition being the result of a tubal abortion.

THOMAS W. HUNTINGTON, of San Francisco, considered it

a wise precaution to remove at an early date in pregnancy what he termed an "occult" appendix, that is, one causing few symptoms but which every now and then gave sufficient evidence of its existence to warrant removal, considering that adhesions might result from such an appendix which might later be a source of serious difficulty.

ELLSWORTH ELIOT, JR., of New York City, cited a case of a young woman 18 years of age, supposed to be suffering from an attack of acute appendicitis, in whom operation revealed no disease of the appendix but the peritoneum filled with blood, there being found a laceration of the right Fallopian tube near its fimbriated extremity. This extremity was amputated and microscopical examination gave no evidence of a tubal pregnancy.

LEONARD FREEMAN, of Denver, referred to a case in the practice of one of his brother physicians, in which an athletic young lady in vaulting a fence experienced violent pain and collapse. Exploration demonstrated a Fallopian tube torn near its centre; ovaries, other tube, and uterus normal in every way with no sign of pregnancy.

JOHN B. DEEVER, of Philadelphia, stated that he considered acute appendicitis more important in the female than in the male, and that he believed salpingitis often resulted from the condition of the appendix. In his experience he had seen more cases of tubal abortion than of tubal rupture. In acute appendicitis during pregnancy, he advocated immediate removal of the appendix.

RICHARD H. HARTE, of Philadelphia, related the history of a patient, a woman long past the menopause, who was driving when she suddenly experienced violent pain on the right side; operation disclosed a large ovary, about twice the normal size, ruptured directly across, and the pelvis filled with blood. The ovary was removed, and after much examination microscopically a report was finally sent in of angiosarcoma. This case occurred over a year ago, and up to the present time there has been no recurrence of the condition in the pelvic organs.

ROBERT G. LE CONTE, of Philadelphia, detailed a case practically similar to that reported by Dr. Primrose, occurring in his practice a short time previously. The patient was admitted to the hospital with all the symptoms of ruptured ectopic pregnancy; at operation a quart of clotted and fluid blood was removed; the

right ovary was ruptured and had the appearance as if a Graafian follicle had existed filled with blood and been torn across, the vessels still bleeding; ovary was removed and tube left. The pathological report had not yet been received, but it more closely resembled a laceration of the ovary than an extra-uterine pregnancy.

A. VANDER VEER, of Albany, reported a case in which a diagnosis of intraperitoneal hemorrhage was made but operation not performed. The patient recovered slowly but completely, having an icebag applied and being kept in a condition of complete rest. He also referred, in connection with Dr. Richardson's paper, to a paper of his own on the subject of pregnancy complicated with inoperable cancer of the cervix, and said that it was his custom under such circumstances to advocate the emptying of the uterus.

CHARLES A. PORTER, of Boston, related the history of a woman of 30, married and pregnant two months, who had pain, tenderness, and fever, then increasing constipation, and tenderness in the left iliac fossa. Visible peristalsis. Operation showed an almost complete obstruction of the cæcum and a large intramesenteric abscess, probably a diverticulitis. Abscess was drained and a lateral anastomosis was done without excision. Patient has made a good recovery, and so far, two months since operation, there has been no interference with the pregnancy.

MAURICE H. RICHARDSON, of Boston, stated that he had frequently seen a ruptured Graafian follicle and had removed more than one ovary, considering it to be the cause of an intraperitoneal hemorrhage, which he now believed might have been simply an excessive hemorrhage during menstruation without any pathological significance whatever.

ACUTE DIVERTICULITIS OF THE SIGMOID FLEXURE OF THE COLON.

CHARLES A. POWERS, of Denver, Col., read a paper with this title, for which see page 118.

CANCER OF THE RECTUM AND RECTOSIGMOID.

WILLIAM J. MAYO, of Rochester, Minn., read a paper with this title, for which see page 240.

THE TREATMENT OF FISTULA IN ANO.

ARTHUR W. ELTING, of Albany, read a paper with this title.

JOHN H. GIBBON, of Philadelphia, agreed with Dr. Mayo that a two-stage operation was the one to be preferred in cases of carcinoma of the rectum with the growth situated high. By doing a preliminary colostomy he had in two instances been able through his abdominal wound to diagnose metastasis in the liver, which occurs very early in young people, and which contra-indicates the performance of a radical operation. It is now his custom to perform a preliminary colostomy and then a few days later to remove the growth. In regard to Dr. Elting's paper he stated that he had derived great satisfaction recently from injecting the fistulous tracts of fistulæ in ano with methylene blue, which greatly facilitates their dissection.

FREDERIC KAMMERER, of New York City, with reference to cancer of the rectum and rectosigmoid, stated that he considered it of the greatest advantage to allow the bowel to drain for two weeks, and to irrigate the lower intestine not only to diminish the sepsis, but also to gain another point, which was that frequently after such drainage made possible by the establishment of a preliminary anus, the growths in the rectum not infrequently became smaller and different in appearance, and the later operation became much more simple. He adheres to the establishment of a preliminary anus and the resection according to Kraske, after an experience with this method of about 70 cases.

W. L. ESTES, of South Bethlehem, Pa., called attention to the fact that one was apt in dealing with rectal cancer to lose sight of the type of carcinoma with which one had to deal, and stated in this connection that it was now generally conceded that the adenocarcinoma, as compared with other forms, has little tendency to recurrence. In his experience of 50 cases he had operated upon several supposedly hopeless cases in which the patients made most satisfactory recoveries. He agreed with Dr. Kammerer in that preliminary colostomy was frequently followed by a change in the appearance of the tumor, much of the size of which is due to inflammation, and in substantiation of this reported a case. He strongly advised that before attempting a radical operation in these cases a portion of the growth be excised

and examined in order to ascertain the true malignancy of the type of tumor present.

NATHAN JACOBSON, of Syracuse, N. Y., reported a case of diverticulitis simulating in its symptoms left-sided appendicitis. He stated also that in his experience the Kraske operation for cancer of the rectum and rectosigmoid had proved most successful, and he had not yet come to the point of establishing a permanent colostomy opening with complete excision of the rectum.

LEWIS L. MCARTHUR, of Chicago, reported a case of diverticulitis with unusual features. The patient had 16 years previously been operated on by another surgeon for a strangulated femoral hernia, and at the time the speaker operated a cord of omentum was found included in the femoral ring, and below this the lower portion of the sigmoid was so constricted that there was back pressure into the colon, making a condition recognized as a diverticular projection. There were over 200 diverticuli sticking out all over the sigmoid and descending colon. This patient recovered. With reference to Dr. Mayo's paper, he stated that in 1887 he recommended in cases of carcinoma of the rectum low down, in the female past the menopause, a resection of the posterior wall of the vagina for approach to the growth, then total excision of the lower part of the rectum, and suture between the upper angle of the vaginal wall and the rectal wall above, using the vaginal tract for an artificial anus. He at that time presented a patient so operated upon, in good condition three years later.

HOWARD LILIENTHAL, of New York City, said that in operating upon fistulæ in ano he would hesitate to follow the radical method advocated by Dr. Elting, fearing that a stricture difficult to overcome might result, or a serious infection take place endangering the patient's life.

EMMET RIXFORD, of San Francisco, added two cases of acute diverticulitis to those referred to in Dr. Powers's paper, in one of which, preparatory to operation, a dose of castor oil was administered; this evidently caused the tearing away of some adhesions, acute peritonitis set in, and the patient died.

FRED B. LUND, of Boston, briefly reported two cases of diverticulitis. In regard to cancer of the rectum he considered the Kraske operation very satisfactory in obese males, and stated

that wherever possible the abdomen should be opened and a permanent artificial anus established. In thin females in good condition and with a non-obstructing carcinoma, he considered the abdominal operation, one-stage, to be safe.

FRANCIS B. HARRINGTON, of Boston, added another case of suppurative diverticulitis to those already mentioned. In this case four inches of sigmoid were resected with a very satisfactory result.

KENNETH A. J. MACKENZIE, of Portland, Oregon, objected to the resection of the mucosa in fistulæ in ano from the viewpoint that if done in the presence of an infection severe sepsis might result and primary union become impossible. The advantages of radical operation are to be found in tuberculous fistulæ, for here the dangers of the ordinary operations are very serious, because they open up the granulomatous material lining the tract and allow dissemination of the tubercle bacilli.

THE EVOLUTION OF NEW BONE AND ITS RELATION TO THE REPRODUCTION OF JOINTS AFTER ANKYLOSIS.

JOHN B. MURPHY, of Chicago, Ill., said that the accurate appreciation of the embryology of bone is essential to a fuller understanding of the pathological processes and the reproductive power of bone. Ossification occurs in long bones through the division of the cartilage cell and the disturbance of the cartilage cell membrane from what is called the ossific centre. The osteoblasts then spread through all of the cartilage of the shaft, or better, the cartilage cells become transformed or displaced by osteal cells from one epiphysis to the other. This is what is known as cartilage ossification. The second type of ossification which takes place in flat bones, and particularly the bones of the face, is an ossification in a white fibrous tissue. In the embryo we have the representation of the bones of the face first in a white fibrous connective tissue; ossification starts in the centre or margin of this and spreads through all of the tissue. Ossification of white fibrous tissue takes place pathologically in the continuation of the periosteum as represented in the white fibrous tissue of the capsule of joints, particularly of the hip-joint. Ossification in white fibrous tissue takes place in the white fibrous strands of the muscle in myositis ossificans. Ossification can take place and does take place in blood-clots that occur near a lacerated periosteum or near a fracture. This ossification is believed to be due

to osteoblasts that have been carried by the blood stream from the fracture or from the lacerated periosteum, as was advocated by Macewen. The degree of ossification is limited by the periosteum or may be limited by the covering of the end of a bone by any of the mesoblastic type of tissues. In other words, when a fracture occurs, if the ends of the bone be covered with a fascia and muscle or a quantity of fat, no effort is made by the osteoblasts of the medulla, the compact bony tissue, or the subperiosteal layer to reproduce bone across the gap. If, on the other hand, the gap between the ends of two bones is filled by a blood-clot and not by an organized connective tissue in fractures of the long bones, a large area, an inch, an inch and a half, or two inches, may be spanned by the osteogenetic elements in their efforts to reunite the bone. In fractures of the flat bones there is no such prodigious effort made to produce a union; they rarely span one-quarter or one-half inch in their effort at the re-establishment of union after fracture. This is noticeable in the mandible and in the trephining operations and fractures of the skull.

We can to advantage divide the osteogenetic elements of bone, or liken the osteogenetic elements of bone to that of a tree, the medulla representing the trunk and always carrying the greatest osteogenetic potency; the Haversian canals, canaliculi, and lacunæ representing the branches of the tree, always carrying osteoblasts on the walls of the Haversian vessels; and the leaves are represented by the subperiosteal osteogenetic layer, in which in youth there is an enormous osteogenetic potency, in middle age a mild degree, and in advanced age no osteogenetic power. The periosteum of the epiphysis has no subperiosteal osteogenetic potency or inductiveness. The fact that this has no bone producing power accounts for the absence of callus and osteomata on the side of joints following fractures of the epiphysis. It will therefore be seen in the regeneration of bone we must utilize either the osteoblasts of the medulla, the Haversian canals of the lacunæ, or the osteogenetic inductiveness of the subperiosteal zone. We can set it down as a fairly well-established fact that in bone transplantation and bone grafting and bone reunions the following principles must be complied with:

1. The periosteum fully detached from bone and (1) transplanted into a fatty or muscle-tissue bed in the same individual, if he be young, may produce a lasting bone deposit; (2) transplanted into another individual or animal of the same species and

under the same conditions, it rarely if ever produces a permanent bone deposit; (3) transplanted into another species it never produces a permanent bone deposit.

2. Periosteal strips elevated at one end from the bone and attached at the other, if turned out into muscle or fat, reproduce regularly bone on their under surface for a greater portion of their entire length.

3. Transplanted into other individuals or animals of same species and contacting at one end with exposed or freshened bone, it rarely produces permanent bone, even for a small extent at its basal attachment, and never produces bone for its full length.

4. Bone with its periosteum transplanted into muscle, fat, etc., in the same individual, and free from bony contact, practically always dies and is absorbed, except in the case of very young children or infants. Transplanted into another species it is always absorbed.

5. Bone transplanted without the periosteum into the muscle or cellular tissue always dies and is ultimately absorbed.

6. Bone with or without periosteum transplanted in the same individual and contacted with other living osteogenetic bone at one or both of the ends of the transplanted fragment always becomes united to the living fragments and acts as a scaffolding for the reproduction of new bone of the same size and shape as the transplanted fragment if asepsis is attained. This new bone increases to such size as is necessary to give the support required by nature in the extremity in which it has been placed. It will scaffold the production of new bone even into the joint when it is surrounded by capsule, and tuberosities are produced in about the regular location, as in the normal anatomic conformation.

7. The transplanted fragment, no matter how large or how small, is always ultimately absorbed. The rôle it plays is to give mechanical support to the capillaries and blood-vessels with their living osteogenetic cells, as they advance from the living bone at both ends of the transplanted fragment into the Haversian canals, canaliculi, and lacunæ of the transplant. New lamellæ are deposited around the new capillaries, and these lamellæ fit into and adjust themselves in the graft, so that the bony union is actually formed and mechanical support given long before the transplant is entirely absorbed and replaced by new bone. Ultimately, all of the transplant disappears as new lamellæ are formed by the osteoblasts, and the graft lamellæ are removed by the osteoblasts.

The practical application of bone transplantation is to the following conditions:

1. To correct deformities resulting from defects of development, as aplasic extremital bones—radius, ulna, humerus, tibia, fibula, and femur, and congenital saddle-nose, aplasia mandible, etc.
2. To reproduce union in ununited fractures.
3. To replace bone removed by destructive infections, osteomyelitis, tuberculosis, lues, etc.
4. To restore or supplant fragments dislodged or destroyed by fractures, as the head of the humerus, head of femur, shaft of tibia.
5. To replace bone removed for non-malignant neoplasms, cysts, myeloma, osteitis fibrosa, etc.
6. To replace bone removed for encapsulated malignant disease, as giant-cell and chondral sarcoma, etc.

Dr. Murphy submitted a series of cases in which bone transplantation has been resorted to to fulfil the requirements mentioned in all of these particular conditions. (For illustrations see J.A.M.A., vol. lviii, No. 15, pp. 1097, 1098, 1099, 1100.)

ACUTE INFLAMMATION OF LONG BONES.

ROBERT G. LE CONTE, of Philadelphia, read a paper with the above title, for which see page 150.

THE SURGERY OF LONG BONES.

JAMES E. MOORE, of Minneapolis, read a paper with the above title, for which see page 155.

THE TOMATO JOINT.

ROBERT W. JOHNSON, of Baltimore, read this paper, for which see page 147.

END RESULTS OF FRACTURES OF THE SHAFT OF THE FEMUR.

W. L. ESTES, of South Bethlehem, Pa., read this paper, for which see page 162.

OPERATIVE FIXATION IN INFECTED FRACTURES OF LONG BONES.

HOWARD LILIENTHAL, of New York City, read this paper, for which see page 185.

OPEN TREATMENT OF FRACTURES.

EDWARD MARTIN, of Philadelphia, read a paper with this title.

OPERATIVE TREATMENT OF FRACTURES.

JOHN B. WALKER, of New York City, reported a series of 21 cases of fractures of the femur, in which operation was performed only after the best efforts of conservative treatment had failed. In every case before operation general anæsthesia had been employed to assist the efforts in reduction, also suitable extension had been applied. Nevertheless, in every case there persisted over 2.5 cm. shortening. Axial rotation was present in all such cases, together with angulation.

In operating the writer tries to scrupulously carry out every minute detail of Lane's technic, for there is no province of surgery in which results depend more upon the mechanical skill and cleanliness of the operator. Under no circumstances whatever do the fingers ever enter the wound. After the strong plate has been most satisfactorily applied by snug screws to the shaft of the femur it would seem as if no motion were possible. If, however, moderate strain be applied to the leg, some motion at the fractures can be appreciated. If this be continued the screws will become loosened and the fragments disarranged. For this reason no strain must be permitted. The plate must be considered only of value merely to approximate the fragments and not at all sufficient to hold them. For this purpose the whole reliance must be placed upon the solid external plaster cast, most accurately and carefully applied. If this does not succeed in absolutely immobilizing the fragments, the operation may fail.

There has been no mortality. In only one case was the plate removed and that was in one of the earlier cases when the operator was somewhat apprehensive, but when he cut down to the plate the screws were solid and it would have been unnecessary. Operations performed under the above indicated methods have been followed by excellent results. If this is possible in the cases of old, long-standing difficult fractures of the femur, how much more easily and more quickly can it be done in recent cases, and with how much greater safety and surety of securing an earlier and better functional result. It now appears that sufficient evidence has been shown to definitely recommend operations for fractures of the femur in such cases as where reduction is inadequate. Adequate reduction requires that the ends remain in apposition with-

out obvious angulation or axial rotation, and that the shortening be not greater than one-half inch. Further efforts to secure reduction by extension should not be continued after seven days, as it has been frequently demonstrated that where over-riding could not be pulled down in that time, no benefit could be gained by longer traction. Results warrant the belief that operations are indicated upon the femur in fractures of the upper and lower thirds, when the fragments are much displaced (as they frequently are) and in spiral fractures of the shaft; upon the humerus, in fractures of the surgical neck with dislocation or rotation of the head of that bone; and in fractures just above the elbow-joint; upon the radius and ulna when both bones are fractured; upon the radius when fractured at the junction of the upper and the middle thirds; and at the elbow- and ankle-joints, whenever the fragments cannot be replaced satisfactorily. Failures or disasters attending the open treatment of fractures are not due to the broad principle underlying the undertaking, but rather to inexpertness on the part of the operator or to faulty technic.

In fractures, the rapidity of union is proportional to the accuracy of reduction and the retention of fragments; delayed union is very largely due to faulty adjustment. Plating the fragments does not increase the nutrition but it brings the fragments into early intimate contact. "As our experience grows, we will be able to select, after a study of the X-ray plates, those cases in which operation is indicated."

CHARLES L. SCUDDER, of Boston, called attention to the fact that in this country, at least, the operative treatment of fractures was being carried out very thoroughly in order to reach a conclusion with regard to its merits, but he did not think the non-operative treatment received its share of attention in our medical schools and among the profession, and that it was therefore unfair to compare the results of the two methods. He believed that the ideal toward which all should strive would be that point where a surgeon on seeing a fracture could definitely make up his mind as to which method, the operative or the non-operative, would give the best results, and to proceed accordingly. He approves of the operative treatment in carefully selected cases, but believes many results obtained by it might also be obtained by the ideally carried out non-operative treatment in the ordinary cases.

JOSEPH RANSOHOFF, of Cincinnati, emphasized the fact that about 70 per cent. of fractures are not treated by surgeons,

but by the country practitioner, etc., and that it should be an aim of the Association to put means in such practitioners' hands to facilitate the reduction of fractures. For this purpose he proposed the use of a pair of common ice-tongs, which could be bought in any hardware store for a dollar and a half. These tongs can be driven into the lower end of a fractured femur without the use of an anæsthetic, and extension up to 40 pounds can be put on, which will usually prove sufficient for reduction. He had overcome the possibility of stiffness of the knee-joint resulting, by applying these tongs with the limb on a double-inclined plane.

JOHN B. ROBERTS, of Philadelphia, did not agree with Dr. Murphy in regard to the drainage of joints, that a man who put in a drainage and had a resulting ankylosis was to blame for that ankylosis since ankylosis had developed in cases where there had been no drainage. With regard to fractures he saw no reason for so much stress being laid on shortening, considering the great assymetry existing in many uninjured legs. He believed the simplest and least complicated apparatus for reduction was the best. He reported two cases ending fatally after the operative treatment for fracture of the femur, and stated that well-tried non-operative means in the great majority of cases would prove efficient, although admitting that under special circumstances the operative treatment may become necessary.

THOMAS W. HUNTINGTON, of San Francisco, believed as a rule, in the hands of competent and skilled surgeons, the operative treatment of fractures was safe. With regard to the introduction of foreign bodies in the treatment of compound fractures, he called attention to the fact that before treatment could be instituted in many cases there was an infection of the medullary cavity, and the introduction of such foreign bodies provided an inviting field for the extension of such infection along the medullary cavity with a resulting osteomyelitis and possibly either loss of a limb or the patient's life. He believed in pursuing the policy of allowing compound fractures to take their own course with as little interference as possible after apposition of fragments is obtained, until after the wound is healed and danger of osteomyelitis is passed. He reported one very successful case in which a portion of the fibula was transplanted into a defective tibia.

MAURICE H. RICHARDSON, of Boston, laid stress upon a statement made by Dr. Estes to the effect that the operative treat-

ment of fractures should *only* be performed by skilled men under the most favorable circumstances, and stated that he believed this to be the consensus of opinion throughout the Association.

OTTO KILIANI, of New York City, said that it should be impressed not only upon the profession but also upon the laity that excellent functional results could be obtained without an anatomically perfect alignment of bony structure. He would be extremely interested to hear the history of the patients whose fractures had been plated say ten years after operation, to see how many of these foreign bodies still remained in place.

FRED. B. LUND, of Boston, stated that in employing the operative method on old fracture cases there was the difficulty to be overcome presented by callus and adhesions, and that the majority of bad results were in such cases. He believed that in carefully selected cases this operative method was applicable to early fractures, particularly those of the long bones, transverse fractures of the femur, certain oblique fractures of the tibia with much overlapping, fractures of the humerus where the ends do not come together, and fractures of both bones of the forearm, and referred to several extremely good results obtained. He considered that a patient was more comfortable when put in a plaster-of-Paris spica dressing than with a Buck's extension with which the adhesive plaster is so apt to slip. In reference to Dr. Moore's paper in which was mentioned the use of bone wax in the bone cavities resulting after the curetting of osteomyelitis, Dr. Lund said that he had obtained most excellent results from lining the cavity with a skin graft.

A. T. BRISTOW, of Brooklyn, reported nine cases of fractures of the shaft of the femur operated upon during the last 18 months; each case healed by first intention and obtained an excellent result, and the patients ranged in age from 11 to 60 years. In every instance every conservative means known to the operator was tried before resorting to the more radical procedure, but where it was impossible by the older methods to get reduction, on cutting down on the fragments it was found that there was muscular or fascial tissue interposed between the ends of the fragments.

GEORGE E. ARMSTRONG, of Montreal, Canada, suggested a device which should always be tried in compound fractures in order to lock the fragments, and that was to notch the ends so that they would dovetail into each other; he had obtained

excellent results by this procedure. He felt the importance of impressing upon students the absolute asepsis which must be obtained in the treatment of fractures by the open method even beyond that necessary in abdominal operations, and that this operative method should not be attempted if it was possible to lock the fragments without it.

LEONARD FREEMAN, of Denver, called attention to many points of advantage, in his estimation, in the use of the external bone clamps to the internal bone plate.

CHARLES L. GIBSON, of New York City, said that he considered it was perfectly proper for Mr. Lane, with his marvelous technic, to operate on fractures, but that only one man in a thousand was so qualified, and therefore he endorsed the opinion that such work should be undertaken only by skilled surgeons.

G. G. DAVIS, of Philadelphia, said that not enough attention was paid to the methods of lateral traction or abduction in the reduction of fractures of the femur, and too much attention was given to Buck's extension, he having arrived at this opinion after seeing a large number of cases of ununited fractures in which the latter method had been employed.

RICHARD H. HARTE, of Philadelphia, gave as his opinion that many of the poor results obtained in simple fractures treated by the conservative methods to-day were due to the fact that the setting and reduction of these fractures in the large hospitals are as a rule relegated to the hospital interne, whose experience is not sufficient to warrant such responsibility being placed upon him. The attention of the chief, all too frequently, is only directed to fracture cases when they begin to do badly. He deplored the scant attention given at the present day in the medical schools to the teaching, both didactic and clinical, of this most important subject.

FRANCIS J. SHEPHERD, of Montreal, in speaking of the merits of the X-ray, also mentioned the fact that the laity at present considered it necessary to obtain, as had been said, almost a cabinet-maker's apposition of fragments, and that since the use of the X-ray it had been shown that this seldom was obtained. He considered it important to educate everybody to understand that it was the functional result and not the anatomical result toward which attention should be directed.

JOHN H. GIBBON, of Philadelphia, stated that he did not consider anæsthesia in the reduction of bad cases as helpful as did many others, and emphasized the fact that one cannot jerk

a fracture into place in five minutes, but that in many cases where the traction is allowed to extend over several days and there is a long and steady pull, the reduction may be easily accomplished; this applied particularly to fractures of the upper third of the femur and the surgical neck of the humerus. He also suggested that in fractures of the surgical neck of the humerus treated by abduction and Buck's extension, with the arm at right angles to the chest and the patient in bed, reduction could be safely accomplished.

LEWIS L. MCARTHUR, of Chicago, suggested the advisability in bad cases of reducing the fracture, if possible, then taking an X-ray picture and telling the patient that such was the best result to be obtained by mechanical methods, and allowing the patient the privilege of deciding, in case the position was not satisfactory, whether or not he desired operative interference, always explaining to him, however, that a functional result could be obtained without a perfect anatomical result.

ALBERT VANDER VEER, of Albany, cited instances in which X-ray pictures had not been at all encouraging as to the end results to be hoped for, but in which the patients ultimately obtained most satisfactory functional results.

WILLY MEYER, of New York City, reported an instance in which entirely too much reliance was placed on the findings by X-ray, the patient being repeatedly subjected to attempts at reduction, until finally, on falling into the speaker's hands, reduction and immobilization resulted in a good functional result, where the first surgeon had decided that only operative interference would be of avail.

THORKILD ROVSING, of Copenhagen, in discussing the reduction and treatment of fractures, referred to the successful results he had obtained from the use of Lambotte's method; he especially advocated its employment in compound fractures. With regard to aseptic ankylosis in joints he had met with considerable success in preventing it by the use of the injection of sterilized vaseline into the joint.

JOHN B. MURPHY, of Chicago, in discussing Dr. Le Conte's paper on acute osteomyelitis, said he considered it one of the most important subjects before the profession to-day, being in reality a condition like a gangrenous appendix in the end of the bone. He emphasized the necessity for early and radical operation, stating that a delay of 48 hours was not only extremely serious

but often fatal. In these cases he suggested the advisability of utilizing the method of bone transplantation after resection of the diseased portion.

TREATMENT OF THE DEFECT OCCASIONED BY PARTIAL EXCISION OF THE INFERIOR MAXILLA.

STANLEY STILLMAN, of San Francisco, read this paper, for which see page 70.

THE CONSERVATIVE TREATMENT OF GIANT-CELL SARCOMA.

JOSEPH C. BLOODGOOD, of Baltimore, read this paper, for which see page 210.

WILLIAM B. COLEY, of New York City, disagreed with Dr. Bloodgood in the statement that giant-cell sarcoma never produced metastasis, and gave a detailed history of a case proving this point, and from this experience concluded that there were certain cases of giant-cell sarcoma in which it was not safe to use conservative treatment and in which even the most radical treatment, amputation of the proximal joint, offered little or no chance of a cure. He briefly referred to 20 cases in which the clinical diagnosis of giant-cell sarcoma was confirmed by the microscope; 10 were of periosteal, 10 of central origin. In 15 of the 20 cases the mixed toxins of erysipelas and *Bacillus prodigiosus* were used before or after operation. In 10 cases amputation was performed. In nine cases either no operation or a conservative one (curetting) was done; in three of the nine cases the disease was too far advanced for the most radical operation, even a hip-joint amputation, and in one case, a subperiosteal sarcoma of the femur involving the lower third, metastasis had taken place. This patient is now well ten years after the toxin treatment was begun. In addition there had been two recent cases of sarcoma of the long bones in the hands of English surgeons in which the limb was saved by the use of the mixed toxins. He reported 21 cases out of a personal series of 107 cases of sarcoma of the long bones, in which the patient lived and remained well more than three years after operation; he believed the value of the mixed toxins in many of these cases to be quite beyond question.

EMMET RIXFORD, of San Francisco, referred to a case of giant-cell sarcoma of the lower end of the ulna treated by resection of the lower end of the bone, which had remained well without recurrence for 18 years.

JOHN B. MURPHY, of Chicago, said that in judging of the malignancy of a giant-cell sarcoma he relied more upon the X-ray picture than upon the microscopical examination; that the disease in malignant cases would be found to cross the epiphyseal line, while in the more benign form it did not do so. He approved more of resection than of curettement in these cases, following the resection of diseased bone by the transplantation of another piece of bone for the maintenance of support.

THE ETIOLOGY OF CONGENITAL DISLOCATION OF THE HIP.

EMMET RIXFORD, of San Francisco, read this paper. It will be published in a later issue of the *ANNALS OF SURGERY*.

CENTRAL DISLOCATION OF THE HIP.

GEORGE TULLY VAUGHAN, of Washington, read a paper with the above title.

PERMANENT INTUBATION OF THE THORACIC AORTA.

ALEXIS CARREL, of New York, reported the results of experimental intubation of the thoracic aorta in dogs, and illustrated his remarks by a series of lantern slides.

BULLET WOUND OF THE SPINAL CORD.

W. B. COLEY, of New York City, read this paper, for which see page 60.

EDWARD MARTIN, of Philadelphia, reported a case of fracture dislocation occurring between the sixth and seventh dorsal vertebrae giving all the evidences of complete transverse lesion, in which a laminectomy was performed, but with a fatal result.

FRANK E. BUNTS, of Cleveland, reported two cases of gunshot wound of the spinal cord. In one the bullet partially crushed the cord, the patient being totally paralyzed in the lower limbs. The bullet was removed and the patient has been making a slow but gradual improvement. The second case was a patient shot through the right lung, the bullet coming out back of the left scapula; patient totally paralyzed through the lower extremities; refused operation. Dr. Bunts considered that these two cases, one operated upon and one not operated upon, would give an excellent opportunity for showing the best method to pursue in these cases.

END RESULTS OF OPERATIONS FOR BRAIN TUMOR.

WILLIAM J. TAYLOR, of Philadelphia, read this paper, for which see page 55.

SURGERY OF THE ARTERIES.

ALBERT VANDER VEER, of Albany, read this paper, in which he recorded experiences antedating the antiseptic era.

THE TREATMENT OF SUBCLAVIAN ANEURISM.

ELLSWORTH ELIOT, JR., of New York City, read this paper, for which see page 83.

ALBERT E. HALSTEAD, of Chicago, stated that the patient operated upon by him for subclavian aneurism and referred to in Dr. Eliot's paper was still alive 20 years after operation. Dr. Halstead had had two more traumatic aneurisms of the subclavian, one an arteriovenous of the third portion from gunshot wound, which recovered after ligation of both the proximal and distal end of the artery. The second case was that of an Italian shot through the left shoulder; twelve days after the injury he developed an aneurism of the left subclavian. On attempting to perform a proximal ligation the operator accidentally opened the aneurismal sac and was therefore compelled to do both a proximal and a distal ligation; the left arm was amputated above the elbow within two weeks. It was the speaker's opinion that no man was justified in doing an arterioplasty on an aneurism excepting in certain cases of traumatic aneurism; in other instances distal and proximal ligation will be found efficient. Suture of the vessel only means temporary circulation, not permanent, and there is the risk of losing the patient from hemorrhage or embolus.

EMMET RIXFORD, of San Francisco, mentioned a method exploited many years ago by Dr. Cooper, of his city, which had in view the closing of an aneurismal sac from the outside by suture. He knew of no case in which the method had been tried, but considered it might be feasible in some instances.

HOWARD LILIENTHAL, of New York City, considered that in subclavian aneurism endoaneurismorrhaphy was impracticable. He considered that microbic aneurisms should be studied in a class by themselves, since they differ widely in requirements from the traumatic.

DIRECT GASTRODUODENOSCOPY IN AFFECTIONS OF THE
STOMACH AND DUODENUM.

THORKILD ROVSING, of Copenhagen, Denmark, read a paper on the above subject, for which see page 201.

INTRATRACHEAL INSUFFLATION ANÆSTHESIA.

CHARLES H. PECK, of New York City, read this paper, for which see page 192.

DRAINAGE AFTER INTRATHORACIC OPERATION.

WILLY MEYER, of New York City, read this paper, for which see page 100.

GEORGE E. ARMSTRONG, of Montreal, Canada, said that in the Royal Victoria Hospital the intratracheal insufflation method of anæsthesia was daily gaining favor, it having now been used in about 50 cases. There had been no pulmonary complications, no sore throat, no hoarseness. Even in abdominal operations it had proved satisfactory and was considered to lessen the after-vomiting.

FRED B. LUND, of Boston, stated that this method of anæsthesia had made simple and easy operations formerly considered formidable; he had used it in thoracic operations, in excision of the tongue for carcinoma, excision of the pharyngeal wall for carcinoma, and for the removal of a papilloma of the vocal cord. He was most enthusiastically in favor of the method.

FRANK L. RICHARDSON, of Boston, presented an improved apparatus for the administration of ether by the insufflation method, claiming portability, simplicity, and efficiency for it.

CHARLES A. PORTER, of Boston, also spoke in favor of this type of anæsthesia and had found it most satisfactory; in some cases he considered it by far the safest method.

SAMUEL ROBINSON, of Boston, also presented a special instrument for the intratracheal insufflation of ether, being the instrument now used in the Massachusetts General Hospital. He claimed that it was extremely simple in action and that when once the tube was introduced it ran almost mechanically, requiring very little, if any, change in the ether supply until near the end of the operation. Its regulation is perfect, and it had proved most satisfactory.

ARPAD G. GERSTER, of New York City, said that the intratracheal insufflation method was a routine practice at Mt. Sinai Hospital, but that he had always considered the apparatus

of Elsberg as too cumbersome, and was glad to see simpler apparatus appearing. He thought there was need for still greater simplification and compactness, in order that the apparatus could be available in railroad accident practice, battles, etc.

ELLSWORTH ELIOT, JR., of New York City, said that at the Presbyterian Hospital the use of this method was increasing day by day and had proved most successful and entirely satisfactory. He reported a case which demonstrated, however, that post-operative pneumonia may occur even with this method.

DIAPHRAGMATIC HERNIA.

CHARLES L. SCUDDER, of Boston, Mass., reported a case of non-traumatic diaphragmatic hernia in an adult. The diagnosis of the existence of the hernia was made previous to operation. An operation for the repair of the hernia was undertaken in two stages: at the first operation the obstructed intestine was removed from the hernial orifice: three weeks later through an abdominal incision the contents of the hernia, including stomach, large omentum, and transverse colon, were reduced into the abdominal cavity and the hernial orifice sutured. The case is reported one year following the operative procedure. The patient is well and has resumed his regular work of laborer.

LEONARD FREEMAN, of Denver, presented two skiagraphs substantiating what the author has said regarding the value of the X-ray in making a diagnosis of diaphragmatic hernia. One picture was from a case in which hernia was not suspected, the condition being assumed to be due to pleural effusion, the result of a broken rib. The patient was operated upon, the abdomen opened, and a large opening found in the posterior portion of the diaphragm near the central line through which the fist could be inserted; the stomach had gone through this and an attempt to draw it back into the abdominal cavity was unsuccessful because of the suction. The stomach contents were then forced down and the stomach replaced in the abdominal cavity. The patient expired in a short time. It was the speaker's opinion that had the operation been performed through the chest rather than through an abdominal incision the patient would have stood a better chance of recovery.

NATHAN JACOBSON, of Syracuse, reported two cases of diaphragmatic hernia, one of traumatic origin, the other congenital, in which the diagnoses were made before operation and before the use of the X-ray.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held at the Roosevelt Hospital, March 27, 1912.

The Vice President, DR. CHARLES N. DOWD, in the Chair.

ACUTE SUPPURATIVE OSTEOMYELITIS OF THE FEMUR.

DR. JAMES I. RUSSELL presented a boy, two years and four months old, who was admitted to the Roosevelt Hospital on July 15, 1910, suffering from pain, swelling and loss of function in the left knee joint. The child's past history was negative, and he had never been sick until his present illness, which began four weeks ago with pain and swelling on the inner side of the left thigh. Two days later he was quite ill with fever, prostration, etc., and was treated for two weeks at home and in another hospital, where tincture of iodine was applied.

On his admission to Roosevelt Hospital the child's temperature was 102.6°; pulse, 120; respirations, 20. A blood count showed 20,300 white blood cells, with 77 per cent. of polymorphonuclears. Examination showed a subperiosteal abscess of the left femur, which was drained by an incision on the inner and anterior aspect of the thigh. There was no apparent improvement following this, and an X-ray was taken, which showed extensive involvement of the femur. On July 30 a more extensive operation was done, which showed that the medullary cavity was infected throughout. On October 7, 1910, a third operation was performed to remove a sequestrum from the lower part of the femur, and subsequently several small sequestra were extruded. Since then the child had steadily gained in health. An X-ray, taken on March 19, 1912, showed a small sequestrum in the lower part of the femur. Otherwise, the bone was more normal in outline and contour.

CHRONIC OSTEOMYELITIS OF THE FEMUR.

DR. RUSSELL presented a boy, 8 years old, who was admitted to Dr. Brewer's service at the Roosevelt Hospital on March 1,

1912, complaining of pain in the right thigh, and inability to walk. The history obtained was that in July, 1911, eight months ago, he had typhoid fever, followed six weeks later by pain and swelling of the right thigh, for which he was operated on in another hospital for "disease of the femur"; a month later a second operation was done for a similar condition, and he remained in that hospital until one week before he was brought to Roosevelt Hospital.

Upon admission, his temperature was 99.2° ; pulse, 100; respirations, 28. A blood count showed 16,000 white blood cells, with 69 per cent. of polymorphonuclears. An X-ray was taken, which showed extensive disease of the femur, with a sequestrum involving practically the lower half of the bone, which appeared as though it had been fractured. The child was in poor condition, pale and anæmic.

Two days after admission an incision was made along the outer side of the thigh from epiphysis to epiphysis. From the lower part of the incision, a rubber drainage tube was removed, and the involucrum, which was much thickened, was chiselled down to permit of the removal of a large sequestrum from the lower part of the wound, while several smaller sequestra were removed from the upper part. On the inner side, the lower one-third of the involucrum was deficient.

After thorough irrigation of the cavity, it was packed with a one per cent. formalin gauze. This was removed 72 hours later, and the cavity filled with Mosetig Morhoff wax and a few skin sutures introduced. The patient showed a moderate rise of temperature after the first operation, not exceeding 101.6° . After the introduction of the iodoform plug, the temperature did not exceed 101° , and reached normal five days later. Since then there had been considerable extrusion of the plug, mixed with pus. An X-ray, taken eleven days after the operation, showed that a good deal of the plug was still in place.

ACUTE OSTEOMYELITIS OF THE TIBIA.

DR. RUSSELL presented a boy, nine years old, who had already been shown at a meeting of the Society about eighteen months ago, and who was again presented at this time to illustrate the development of the bone since the operation three years ago, when a subperiosteal osteotomy was done. The X-ray pictures now suggested a new medullary cavity.

CHRONIC SUPPURATIVE OSTEOMYELITIS OF THE TIBIA.

DR. RUSSELL presented a girl, eighteen months old, who was admitted to the Roosevelt Hospital, in the service of Dr. Darrach, on July 18, 1911. The history obtained was that she had suffered from an abscess behind the ear, which was opened, the wound taking about six weeks to heal. Soon afterwards she developed an abscess on the right leg, which was opened and healed promptly, but about this time the left leg began to swell, and the child became quite ill, with fever, restlessness, etc., and developed an abscess over the left internal malleolus. This subsequently ruptured, and had been discharging up to the date of the child's admission into the hospital.

An X-ray was taken, which showed involvement of the entire tibia. On July 22, 1911, a subperiosteal resection was done. Convalescence was uneventful, the wound healing primarily, and the sutures were removed on the nineteenth day.

In connection with these four cases, Dr. Russell showed a number of lantern slides of the radiographic findings to illustrate the development of the bones after operation.

DR. GEORGE E. BREWER said that in the work of the staff at the Roosevelt Hospital, they were endeavoring, as far as possible, to have the men specialize along certain lines, and for the past two or three years Dr. Russell had been devoting special attention to the cases of osteomyelitis in every form. The four cases he had shown represented only a few of the large number he had operated on, and the results, as shown particularly by the X-ray findings, were very satisfactory. If, in these extensive cases of osteomyelitis, we were able to bring about a regeneration of the bone, the result must certainly be regarded as successful. Many of these cases represented a good deal of painstaking work, and Dr. Brewer said he felt assured that in some instances limbs had been saved which under the older methods of treatment would have been sacrificed.

TUBERCULOSIS OF THE TONGUE: CHRONIC PULMONARY TUBERCULOSIS: HEMIGLOSSECTOMY: INTRATRACHEAL ANÆSTHESIA.

DR. A. V. S. LAMBERT presented a man of 45 who had had chronic pulmonary tuberculosis for the past nine years. A month ago he first noticed a small nodule on the right side of the tongue, opposite a carious tooth. This nodule increased in size

rapidly until it involved almost the entire half of the tongue, the extreme tip and base not being involved. The lesion became ulcerated a week before admission, and since then had become exquisitely tender and very painful.

The patient was anæsthetized with gas and ether, and when he had become completely under the influence of the anæsthetics, the intra-tracheal tube was introduced and the remainder of the anæsthesia was completed by this means. A hemiglossectomy was done very readily, there being no difficulty with the inhalation of blood or secretion. The pharynx remained clear during the entire procedure.

On the day following the operation the patient's temperature rose to 102° ; then promptly returned to normal. The expectoration was increased for the first day; it was slightly blood-tinged, and there was an increase in the number of tubercle bacilli it contained, as compared with the number before operation. The intra-tracheal anæsthesia irritated the chronic pulmonary inflammation but very slightly and kept the pharynx clear of blood and mucus.

GUN-SHOT WOUND OF THE THORAX: WOUND OF LUNG:
HÆMO-PNEUMOTHORAX: POISONING BY BISMUTH.

DR. LAMBERT presented a young man of 21 who received a shot-wound of the thorax. He was immediately brought to the hospital in a taxicab, and upon admission he was unconscious and in a state of profound shock. He was very pale, with a small, rapid, thready pulse. There was pronounced "air hunger," and the respirations were superficial, rapid and gasping in character. The wound of entrance was in the fifth intercostal space, at the right border of the sternum.

The patient was put to bed and given morphine for his restlessness, and hot salines per rectum. After an hour his condition had improved, and he showed signs of fluid in the right chest, posteriorly. This gradually increased in quantity, until the patient developed signs of dyspnœa. A thoracotomy was thereupon done, with partial ostectomy of the ninth rib, and a large amount of bloody fluid was evacuated. This had a pronounced odor, and contained streptococci. There was a positive blood culture of streptococci, and the patient became very ill and septic.

After he had improved sufficiently, his chest cavity, which was very large, was injected with a paste containing bismuth subnitrate, 10 per cent., and formalin, which controlled the growth of saprophytes. For the purpose of taking an X-ray photograph, his chest cavity was injected with eighteen ounces of a $33\frac{1}{3}$ per cent. of bismuth carbonate. Most of this promptly oozed out, but on the third day the patient developed an acute parenchymatous nephritis, which lasted seven days, and was followed by salivation, gingivitis, glossitis and an acute diarrhoea. At the onset of the nephritis, his chest was cleared of the bismuth paste. At the present time, his gums, tongue, the mucous membrane of the cheeks and floor of the mouth and his pharynx were blackened by the deposition in them of metallic bismuth. He had now recovered from the acute symptoms, and was improving.

DR. ROBERT T. MORRIS suggested the use of trypsin, or better, of acidulated pepsin solution, for the purpose of liquefying the coagula. In reply to a question as to whether the action of digestives could be limited, Dr. Morris said he had made some vivisection experiments with digestives which showed that the tendency was for their action to be limited to substances not penetrated by capillaries. He would liquefy part of the coagula; wash out the treacle-like residue, and repeat the process according to judgment in any given case. Coagula in the thorax or in the bladder could be liquefied rapidly.

PHLEGMONOUS INFLAMMATION OF THE LARGE INTESTINE.

DR. CHARLES N. DOWD read a paper with the above title.

VILLOUS ARTHRITIS OF THE KNEE (SARCOMA).

DR. CHARLES N. DOWD said this patient was presented to the Society to illustrate the very extensive formation of villi within the knee joint, and the good effects of operation. The specimen removed showed the great difficulty of accomplishing a cure by other methods and also illustrated the indefiniteness of the group of lesions which were included in the general term "sarcoma."

The patient was a vigorous man, 33 years old, who entered Roosevelt Hospital on August 29, 1911. For 4 years he had suffered from swelling and moderate disability in his knee, having remissions when he rested, and applied bandages and counter-irritants. During the last year he had suffered considerable pain,

and the swelling and disability had increased. He had never had locking of the joint. Physical examination showed a diffuse swelling of the right knee, which in circumference was $2\frac{1}{2}$ cm. larger than the left. Patellar click present. Loose bodies felt on each side of the patella. Tenderness on pressure over both semilunar cartilages. Flexion limited to 95° . No atrophy. No muscles spasm on moderate motion.

On opening the joint, villi were found to an enormous extent, one mass was 2 inches in length and $1\frac{1}{2}$ inches in breadth, it was composed of small nodules and looked like a flat bunch of grapes. Villi projected from many parts of the joint wall, but were most marked on the outer side. Some were hard and cartilaginous; others were soft and moderately vascular (Fig. 1). There was no caseation. There were about two ounces of clear, thick, straw-colored fluid in the joint. As many villi were excised as was practicable, and the joint was washed out with saline solution. The patient made a good recovery, and left the hospital in three weeks.

Last September he returned to his work, which was that of a barber. He stands many hours every day, has good motion in the knee joint, very slight swelling, and almost no pain. The size of these villi was excessive, and one could appreciate the difficulty of treating a joint by external application when there was so much disturbance from the presence of foreign bodies within it. Although we realize the good effects of some forms of treatment and of local and external applications in certain types of villous arthritis, it is very difficult to see how these methods would be efficient in a case in whom the villi had reached such enormous size.

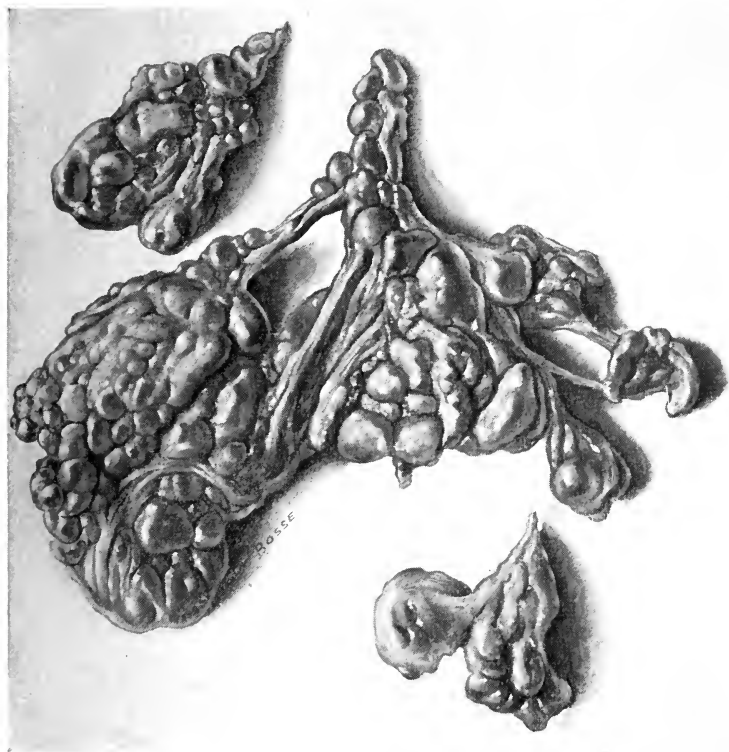
With regard to the confusion which exists about sarcomata, we may cite this as another example of a patient who had a new growth which had giant and spindle cells and which on careful and expert examination was reported as sarcoma.

The examination was made by Dr. Mortimer Warren, who reported as follows:

Specimen.—There are many small bodies having papillomatous projections attached to main tissue by fibrous bands. The cut surface of each is smooth and contains small masses 3 to 5 mm. in diameter, separated from each other by fibrous capsules. They can be shelled out and appear cartilaginous.

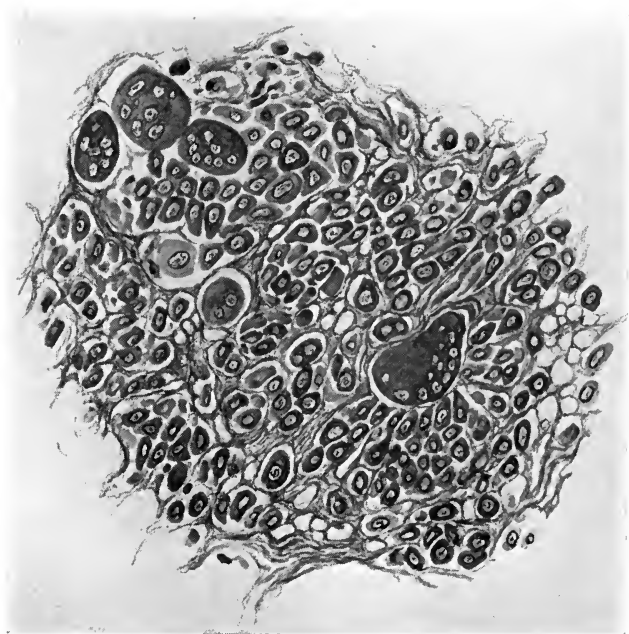
Microscopic Examination.—Periphery consists of an infiltrated vas-

FIG. 1.



Villi removed from the interior of the knee-joint. Microscopical examination showed the specimen to be sarcoma. (Dr. Dowd's patient.)

FIG. 2.



Microscopical section of villous growth of knee-joint ($\times 200$). Sarcoma. Shows giant-cells and detail of stroma.

cular fibrous tissue. The mass of tissue is made of closely packed cells, mostly spindle or oat-shaped. They are separated into large bundles by coarse strands, and into smaller ones by thin fibrils of connective tissue. Scattered about are giant cells (Fig. 2). Blood vessels are numerous and for the most part have good walls, but there are many smaller blood spaces enclosed simply by the tumor cells. Mitotic figures are present.

Diagnosis.—Giant-cell sarcoma.

Some pathologists question the propriety of applying the term sarcoma to many of these giant-celled growths, especially the epulides. On the other hand he had at the present time under observation a growth which was an epulis at first, which was reported as a fibro-sarcoma of apparently very mild virulence and which has proved to be of overwhelming malignancy.

Both clinical and microscopical studies are continually indicating the extreme variability in the group of growths which are called "sarcoma." A variability which is most confusing when we endeavor to estimate the value of various forms of treatment.

The recent studies of Lejars and Rubens-Duval (*Revue de Chirurgie*, No. 41, p. 751) indicate that local resection is not often advisable treatment for sarcoma of the synovia, but one who sees this patient and the appearance of the specimen would hardly think of a more radical form of treatment. A long period of careful observation was desirable.

CARDIOSPASM.

*DR. CHARLES N. DOWD showed a woman, 38 years old, otherwise healthy, who presented a typical picture of cardiospasm.

For about a year she had been suffering from frequent vomiting and from loss of strength and weight when she was admitted to Roosevelt Hospital, June 11, 1911. She had been under the usual forms of treatment and had consulted many doctors. She finally came to the hospital with a diagnosis of cancer of the œsophagus. Her condition at that time was truly pitiable, her weight had diminished from 163 to 119 pounds, and when she attempted to eat she would quickly regurgitate the food, so that she had learned to have a basin beside her when sitting at the table, thus providing for her regurgitations. On coming to the hospital, it was found that a stomach tube passed easily and she was benefited by this passage so that she could

swallow much better for a day or two, but after that time her symptoms returned and were as bad as ever. Gastric contents removed through the stomach tube were found to be normal. The material which was regurgitated did not contain hydrochloric acid, a proof that it came from the œsophagus, not from the stomach. X-ray examination showed a moderate dilatation of the entire œsophagus and constriction of the cardia (Fig. 3). Examination with an œsophagoscope made by Doctors Janeway and Green showed that the stricture yielded easily to pressure, nothing of a cancerous nature was found in it. The benign character of the stricture was further borne out by the fact that there had been no bleeding. She left the hospital temporarily, but on July 25 he dilated the cardia without an anæsthetic, using the Plummer apparatus, running the pressure up to 30 several times and then allowing it to diminish. Her condition on going back to the ward was really remarkable, she went to the dining room, took a glass of water and was surprised to find that she could swallow it perfectly. Her delight was dramatic. She had to repeat the experiment a second and a third time before she was really convinced that her difficulty in swallowing had ceased. The dilating was repeated about once a week until October 1. On November 1 she weighed 140 pounds, a gain of 21 pounds. She looked well and said she was as well and strong as ever. On January 17 she weighed 148 pounds and on March 1 154 pounds. She has recently had an occasional slight gagging when eating. A stomach tube passes, but the Plummer dilator does not pass the cardia. It probably will pass in due time. This peculiarity of sometimes permitting the instrument to pass, at other times not permitting it, is rather characteristic of the disease. In considering this case, it is interesting to note, that she went during a period of more than a year to a large number of physicians and several hospitals and that a diagnosis during that time had not been made. Attention has recently been called to the condition by several writers and no doubt the diagnosis will be quickly made in cases that now come to our notice.

COLLAGOL RADIOGRAPHS OF KIDNEY AND URETER.

DR. CHARLES H. PECK showed a series of these cases, with lantern slide views of the X-ray findings.

CASE I.—The patient was a woman, 52 years old, who gave a history of attacks of right lumbar pain for the past three years.

FIG. 3.



Radiogram taken after ingestion of bismuth paste, showing dilated œsophagus and closed cardia.

These attacks came on at intervals of about every four months, and were usually from twelve to twenty-four hours in duration. The urine during the attacks was sometimes clear; at other times of a reddish tinge, and on one occasion, about two years ago, contained a large amount of pus. No marked variation in the amount of urine passed had been noted. The patient's last attack, which was the most severe, was of two weeks' duration.

A cystoscopic examination was made, which showed no ureteral obstruction on either side, with good secretion from both ureters. The capacity of the right pelvis was 40 c.c., about double the normal. The radiograph for stone was negative, but the collargol radiograph showed a dilated pelvis, with its lower part hooded over the ureteral implantation, so as to cause valvular obstruction when distention occurred.

Operation, February 17, 1912: An incision was made into the dilated pelvis posteriorly, and a small calculus removed. The calices were dilated and the cortex thinned. A cicatricial stricture of the ureter, about half an inch below the pelvis, was carefully dilated up to 15 F. The cortex of the kidney was then opened, and a ureteral catheter with stylet was passed through the nephrotomy wound to the bladder and left there as a splint, and through the same wound a tube was put in to drain the pelvis. The wound in the pelvis was then sutured, and a cigarette drain introduced to the perirenal space.

The ureteral splint was removed on the third day, and the pelvic drain five days later. There was no urinary discharge through the wound after the tenth day. The patient was discharged on the fifteenth day with the wound completely healed.

CASE II.—This was a girl, nine years old, who was admitted to the Roosevelt Hospital on October 28, 1911. For about a year prior to that time she had suffered from attacks of pain in the left kidney region. These occurred at frequent intervals, and three days before her admission she had had an unusually severe attack, accompanied by fever, nausea and vomiting. Her temperature on admission was a fraction below 103° , and on examination of the urine it was found to contain pus. She was kept under treatment in the medical division for two and a half months, and transferred to the surgical service on January 13, 1912, during a sharp exacerbation of symptoms.

Repeated examinations of the urine for tubercle bacilli gave negative results, but on two occasions the bacillus coli communis

was found. The leucocytes varied with the acuteness of the symptoms from normal to 37,000, and the percentage of polymorphonuclears to 92. The patient had periods of almost complete remission from symptoms for days at a time. The cystoscope showed purulent urine from the left kidney. A radiograph for stone was taken, with negative results. The collargol radiograph showed a dilatation of the ureter, with moderate dilatation of the kidney pelvis.

Operation, January 14, 1912: The kidney was found to be moderately swollen, and sparsely dotted with tiny, whitish spots beneath the cortex. Frozen sections from the cortex, including one of these spots, showed no evidences of tuberculosis. The pelvis was inflamed, and moderately dilated.

A nephrotomy was done and a ureteral probe was passed without difficulty to the bladder. A tube drain was secured in the pelvis. The urine drained freely for eight days, when the tube was removed. The patient was discharged 22 days after the operation, her wound having completely healed. The convalescence had been practically uneventful.

CASE III.—The patient was a man, 35 years old, who was operated on for ureteral obstruction and hæmaturia in June, 1907. Cystoscopy at that time showed obstruction of the left lower ureter. A nephrotomy was done and the ureter dilated from above with ureteral probes. No calculus was found.

The patient remained free from symptoms until the day before his admission to the Roosevelt Hospital, on December 19, 1911. A cystoscopic examination was made, which showed an impassable obstruction in the lower end of the left ureter. No urine could be seen coming from the left ureteral orifice.

Operation, December 23, 1911: The ureter was exposed in the iliac region extra-peritoneally and except for the lower 2 or 3 inches, was found to be much dilated. Upon opening it, no stone was found. There was a tight stricture at the intravesical portion, which was finally passed from above with a fine probe and dilated up to 18 F. The ureteral wound was closed by suture, and a cigarette drain introduced. The wound healed promptly, without leakage. On January 4, 1912, a ureteral catheter was easily introduced to the pelvis of the left kidney. A collargol radiograph of this case showed a greatly dilated ureter and pelvis.

CASE IV.—The patient was a man, 32 years old, with a history of intermittent pain in the left lumbar region for several years. The pain was of moderate severity, but disabling while present, the attacks recurring every week or ten days. Physical examination had always been negative. A cystoscopic examination, made in August, 1911, showed good function on both sides, with no ureteral obstruction. As no lesion was found, the patient was discharged. His attacks of pain continued as before, and in October, 1911, he was re-admitted for an exploratory operation. Laparotomy through left rectus showed no intra-peritoneal lesion, but revealed a tensely dilated left kidney. Incision over the kidney showed a hydronephrosis from a hooded pelvis with valvular obstruction of the upper ureter. A portion of the posterior wall of the pelvis was excised, and sutured in such a way as to correct the hooding and valvular obstruction. A ureteral catheter was passed into the bladder from above and left as a splint, and the pelvis of the kidney was drained. On the sixth day after the operation, after removing the drain, an attempt was made to withdraw the ureteral catheter, but this proved unsuccessful on account of some obstruction. On the following day it was withdrawn with considerable difficulty, and a knot was found to have been tied near its tip, evidently from curling up in the bladder.

This patient's convalescence was delayed by a post-operative pneumonia, and he left the hospital, well, on the twenty-third day after operation.

This case, Dr. Peck said, illustrated a condition which could have been easily recognized by a collargol radiograph, had the method been in use at that time.

CASE V.—The patient was a woman, 25 years old, who was admitted to the Roosevelt Hospital on December 11, 1911, with the history that about a month before, after an attack of coughing, she developed a pain in the right kidney region. This radiated downward, with tenderness in the same region, and two days ago it had grown more severe. Palpation showed only moderate tenderness on deep pressure.

The cystoscopic examination was negative. A collargol radiograph showed a sharp kink in the right ureter, about two inches below the pelvis.

Operation, December 15, 1911: The kidney was low in

position, but both kidney and pelvis were normal in appearance, as was the ureter, but upon drawing this out of the wound, careful examination showed a tense, vascular band crossing the ureter at the site of the kink, and over this the ureter evidently hung with the kidney in its prolapsed position. A nephrotomy was done and a ureteral splint inserted to the bladder, with a tube drain to the pelvis. A nephropexy was then performed.

The ureteral splint was removed on the fifth day, and the pelvic drain three days later. A collargol radiograph, taken on the nineteenth day, showed no kink in the ureter. The patient was discharged, well, on the twenty-third day.

DR. ROBERT T. MORRIS said that in using collargol in connection with radiographic work about the kidney and ureter one should bear in mind the possibility of the presence of a calculus having the same index of refraction as collargol itself. The speaker said he had in mind a recent case where the collargol radiograph failed to show the presence of a stone, and yet at the operation a large one was found.

DR. PECK thought the point brought up by Dr. Morris was very important. In their own work, the speaker said, they always took a radiograph before the collargol was injected, and then a collargol radiograph was taken. They had seen no harmful results follow the use of collargol—nothing more serious than slight pain.

DR. BREWER said that a few days ago, while operating on a kidney that had been injected with collargol, he found that about four or five ounces of the solution had remained within the kidney. In the course of the operation, the pelvis was accidentally ruptured, and the collargol solution spilled all over the wound and probably helped to sterilize it.

DR. A. V. MOSCHCOWITZ said he had seen one case of hydro-nephrosis where serious collapse followed an injection of collargol. The patient was in a condition of profound shock, which lasted for several hours, but finally recovered. In this case, Dr. Moschcowitz said, less than two ounces of a two per cent. solution were given, and he had an idea that the injurious after-effects were due to the mechanical rather than the chemical effects of the collargol.

DR. WILLIAM A. DOWNES said he had had one case where a five per cent. solution of collargol injected into both kidneys simultaneously produced intense pain with more or less tender-

ness, that lasted over night. The pain was over the normal kidney—not the one that was diseased. The speaker said he regarded the pain complained of after these injections as mechanical in origin.

DR. PECK said they generally used a 10 per cent. solution, and thus far, in their rather small series of cases, they had seen no ill-effects follow the injections. They had never attempted to inject both sides at the same time, and the collargol was washed out as thoroughly as possible with some bland solution as soon as the radiograph was taken.

MUSCULOSPIRAL PARALYSIS: TRANSPLANTATION OF VEIN.

DR. GEORGE E. BREWER presented a man, 22 years old, who in August, 1911, sustained a fracture of the middle third of the humerus, associated with complete paralysis over the distribution of the musculospiral nerve. Non-union followed conservative treatment, and subsequently the fragments were wired together by an open operation. As there was no improvement in the paralysis, a second operation was undertaken to unite the severed nerve, but this was unsuccessful on account of the inability to find the upper segment.

The patient was admitted to the Roosevelt Hospital two months ago, and again operated on with a view to nerve suture. An eight-inch incision was made over the course of the nerve from the axilla to a point just above the external condyle. The lower end of the nerve was readily found, with its bulbous extremity adherent to the abundant callus. About four inches above this the upper extremity of the nerve was found, with its bulbous end also leading into the callus.

After removal of the bulbed extremities, it was found that the two divided ends of the nerve were separated by an interval of about five inches. The right saphenous vein was exposed and dissected out, after ligating both its extremities, the contained blood remaining within its cavity. The divided ends of the nerve were then inserted into this vein and sutured into place; the external wound was closed, and a dressing applied. Primary union followed.

Up to the present time there had been no change in the paralytic symptoms.

DR. ALFRED S. TAYLOR said that Kilvington of Melbourne had

demonstrated experimentally that if one could transplant nerve substance between the ends of a divided nerve, the chances of regeneration would be better than by other means of bridging, and this applied to both sensory and motor nerves. For this purpose he suggested the use of the long saphenous nerve, cutting it up into segments and forming it into bundles of sufficient size. He thought this method offered a better chance for the regeneration of the nerve than the interposition of a blood clot, which was sure to organize.

Dr. Taylor said that in a case where he operated last August, there was an interim of four inches between the nerve ends which he tried to bridge by interposing the saphenous nerve. There were no evidences of regeneration in that case up to the present time, although it was still too early to expect it. He knew of no case where an interval of over two and a half inches in a severed nerve had been successfully bridged.

EPILEPSY: CRANIOTOMY AND DECOMPRESSION.

DR. BREWER showed a twelve-year-old girl who entered the hospital eighteen months ago, suffering from focal epilepsy. She gave an indefinite history of having met with an injury to the head seven years before. Six months later, a slight spasm of the left eyelid, of short duration, was noticed. This was followed by a number of similar attacks, and later became associated with a jerking of the head to the left. She was put on bromides, and for one year was free from these attacks. Four years ago they recurred, and since that time they had become very frequent, ranging from five or six to twenty or thirty a day. For two years these had been uninfluenced by the bromides.

The attacks began by a spasm of the left eyelid, quickly followed by contractions of the left side of the face, the head turning to the left and the convulsive movements extending to the arm and leg. There had never been complete loss of consciousness. During the girl's stay in the hospital, the spasms averaged twenty a day.

Operation: Upon exposing the right motor area, nothing was found but evidences of increased intracranial tension, with marked hyperæmia of the pia, and a small, thickened area over the lower part of the motor tract. A decompression operation was then done in the temporal region, and the bone flap over

the motor area was replaced. On the day following the operation, she had six light convulsions; on the next day only one, and then they ceased entirely for several months. During the eighteen months which had elapsed since the operation, she had had 41 slight seizures. Her general health is good.

INTERSCAPULO-THORACIC AMPUTATION FOR RECURRENT SARCOMA.

DR. BREWER presented a man, 28 years old, who two years ago suffered from a tumor of the left fifth finger. This was removed, with a subsequent recurrence in the stump, for which the hand was amputated near the wrist joint. There was a second recurrence in the stump of the forearm, followed by amputation in the lower third of the humerus.

When the patient came to the Roosevelt Hospital, there was an extensive recurrence in the stump and also in the axilla. Pathological examinations of the earlier specimens showed the growth to be a mixed-celled sarcoma, and this diagnosis was verified by the removal of a small nodule from the recurrent tumor in the stump.

An interscapulo-thoracic amputation was done by Dr. Brewer six weeks ago. The wound healed primarily, but since then there had developed a small nodule near the point of ligature of the axillary vessels. The patient was now being treated with the X-ray and Coley's mixed toxins.

DR. ELLSWORTH ELIOT, JR., said that about eight years ago he showed a case similar to this one, in which, in addition to the axillary metastasis, the sarcoma had involved the point of the shoulder and the adjacent part of the clavicle and acromion process. The scapula as well as the clavicle were removed, but within a year the patient died of metastases in the vertebral column, which was the rule in these cases. There were very few cases on record where the patients had remained free from recurrence.

DR. WILLIAM B. COLEY mentioned a case of his own, somewhat similar to that of Dr. Brewer's—a spindle-celled sarcoma starting in the metatarsal bursa, which was removed by Dr. Bull, in 1889, a Symes amputation being performed. About 1½ years later a recurrence took place in the soft parts of the popliteal space, which was again removed by Dr. Bull. On account of

a local recurrence shortly afterwards Dr. Coley amputated the thigh just below the trochanter and put the patient upon the mixed toxins which were kept up for a considerable time. A fourth recurrence finally took place in the fascia of the gluteal region; this was removed by operation and the toxins continued for nearly a year, with final cure, the patient remaining well at the time of last observation, ten years afterward.

In the case shown by Dr. Brewer, Dr. Coley thought that an earlier use of the toxins might have prevented some of the previous recurrences.

Dr. Coley, in reply to a question, stated that he had himself performed interscapulo-thoracic amputation in three instances, two adults and one child, all of whom had died within a comparatively short time after operation, two within six months and one within a year. Dr. Nancrede, in his presidential address delivered before the American Medical Association three years ago, collected all the cases in which interscapulo-thoracic amputation had been performed for sarcoma of the scapula, and found not a single case permanently cured.

Dr. Coley stated that one of his cases confirmed what Dr. Dowd had said in regard to the pathological reports not always being a good guide as to prognosis. This was a case of sarcoma of the upper third of the humerus following a fracture, in a boy of ten; the tumor was of extremely rapid growth. Dr. Coley did an interscapulo-thoracic amputation three weeks after the tumor was noticed. Dr. Ewing pronounced the growth a giant-celled sarcoma of mild malignancy and thought the operation was perhaps too radical. In spite of the early and radical operation as well as subsequent use of the mixed toxins, there was an extensive metastatic recurrence in the lung within a year, causing the death of the patient a few months later. Dr. Coley stated that he had a number of cases similar to this, which disproved the dictum of many writers, and particularly of Bloodgood, that a giant-celled sarcoma was never followed by metastases.

In regard to Dr. Brewer's case, Dr. Coley stated that not many years ago an amputation would have been advised in this case. He stated that for a number of years he had strongly advocated conservative treatment in cases of sarcoma of the long bones, *i.e.*, giving a course of toxin treatment, either as a pre-

liminary measure, or after a conservative operation, before resorting to amputation. He stated that within the last two weeks he had had an opportunity of re-examining four cases in which the limb had been saved by the use of the toxins alone or in conjunction with conservative treatment. One of these was a case of giant-celled sarcoma of the lower end of the radius, with spontaneous fracture, in which Dr. Hartley and Dr. Poole, after simple curetting, which established the diagnosis, had advised immediate amputation of the arm, which the patient refused. She was sent to Dr. Coley at the General Memorial Hospital and, under six weeks' treatment with the mixed toxins, without any further treatment whatever, the tumor entirely disappeared and the patient is now in perfect health, four years later.

The second case was referred to Dr. Coley by Dr. Irving S. Haynes, a year ago, for a rapidly growing sarcoma of the radius, giant-celled, with extensive infiltration of the soft parts. He decided to give the patient a brief trial with the toxins before amputation. Under ten weeks' treatment, the disease disappeared and the patient is at present perfectly well. Both of these cases have perfectly useful arms.

The third case was a sarcoma of the tibia with rapid recurrence after three conservative operations, in which the disease finally disappeared under the toxin treatment, in this case combined with a small number of X-ray treatments; the patient is now well seven years, with a perfectly useful limb.

The fourth case was a sarcoma of the femur of the small round-celled type, with extensive metastases in the pectoral, as well as ilio-lumbar region. The patient made a complete recovery under a few months' treatment with the toxins and is perfectly well at present, ten years later.

Dr. Coley stated that he had had about ten cases in all in which the limb had been saved by the preliminary use of the toxins. The cases could be found reported at length in his paper read before the French Congress of Surgery, October, 1911.

SARCOMA OF THE RADIUS: TRANSPLANTATION OF BONE.

DR. BREWER presented a man, 24 years old, who was admitted to the Roosevelt Hospital suffering from a tumor involving the lower end of the radius. The X-ray showed a medullary

growth suggesting myeloma, or possibly chondroma. An incision was made over the flexor surface of the forearm, just external to the tendon of the flexor carpi radialis. A thin sheet of bone covering the projecting part of the tumor was removed, and the entire growth curetted from the bone cavity. Frozen sections showed the growth to be a mixed-celled sarcoma, and the lower three inches of the radius were thereupon removed, together with the periosteum.

A week later the wound was re-opened and three inches of a radius previously removed from an individual who had died as the result of a gun-shot wound of the abdomen was introduced, the soft parts were sutured, and the wound closed without drainage. The wound healed by primary union under the first dressing.

Dr. Brewer said this operation was undertaken in the hope that the implanted bone would result in preserving the normal relation of the parts, and that during its absorption new bone would gradually take its place, being developed from the cortex and endosteum of the healthy fragments.

DR. BREWER, in reply to a question as to why he did not leave the periosteum, said that that had occurred to him, but he decided against it because the shell of bone in the diseased area was exceedingly thin, and he feared that the periosteum had already become infected.

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ORIGINAL MEMOIRS.

A DISCUSSION OF BONE TRANSPLANTATION AND THE USE OF A RIB AS A GRAFT.*

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So far as my recollection goes, no paper on bone transplantation has ever been read before this Society. The object of this report is to bring forth a discussion of this timely topic. My contribution to the subject is two cases and some experimental work, which, while not at all conclusive, is yet suggestive. At some later date I hope to present some definite results along experimental lines.

Our views are changing considerably as to the viability of bone grafts and as to the manner of their growth, but there is great confusion as yet as to the way in which the transplanted bone grows. Let us examine the views of some of the authorities. Ollier says that new bone in transplants is produced by the cellular elements of the marrow and of the Haversian canals but more particularly by the osteoblasts of the periosteum. The cortex of the bone undergoes resorption and proliferation. Three things can happen to it: (1) the bone can be encapsulated as a foreign body in con-

* Read before the New York Surgical Society, April 10, 1912.

nective tissue; (2) the bone can grow into the tissues without remaining living; it comports itself as an absorbable foreign body, is softened, and eventually is replaced by new formed bony tissues; (3) the bone can heal in the tissues and live. As a proof of this he mentions (*a*) its resistance toward resorption, (*b*) the growth of the bone, and (*c*) its vascularization. Barth was the one who endeavored to shatter these views. He declared that not macro- but microscopically must the matter be decided. He maintained that his preparations showed that the bone, periosteum, and marrow always died whether the bone was transplanted with or without periosteum, and that it was replaced by means of the osteogenetic tissues of the surroundings. Axhausen attempted to prove in his thorough experiments that neither Ollier nor Barth were completely right in their contentions but that each was half right. He declared that, of living, periosteum covered, transplanted bone, the periosteum and the marrow live while the bony tissue itself dies. The replacement of the dead bone takes place from the living marrow, but chiefly from the periosteum of the bony graft. This teaching of Axhausen is that accepted by most of the authorities to-day. According to these views, the practical rules for the transplantation of bone may be formulated as follows:

1. The best material for free bony grafts is living, periosteum covered human bone, if possible from the same individual himself (autoplasmy). Or in case this is impossible, from another individual (homoplasty).

2. Bone without periosteum becomes absorbed and is therefore suitable only for transplantation into an osteogenetic bed, such as into a cavity in another bone or into a defect in the skull or for wedging between other bones.

3. Living animal bone is not suitable for transplantation. It heals in living (periosteum and marrow), but its replacement is delayed and the periosteum loses its proliferating power due to the changed serological conditions.

4. Dead bone according to the earlier opinions is likewise unsuitable for transplantation, except for the filling of a

bone-producing defect or when surrounded by living periosteum. The same is true of ivory.

5. Periosteum alone remains living in transplantations, so far as one can transfer animal experiments to human ones.

6. Marrow alone when transplanted has osteogenetic powers.

7. Epiphyseal cartilage transplanted gave Helferich and Enderlen good results. Galeazzi obtained less favorable ones.

8. We have only the works of Wrede and Judet regarding the transplantation of joints. The experiments of Wrede on rabbits were remarkable, the animals ran around without any limp. The bony substance was necrotic, while the periosteum, marrow, and cartilage remained living.

In January, 1912, appeared the epoch-making work of Macewen, of Glasgow, who published a book entitled "The Growth of Bone," in which he bases his conclusions on extensive animal experiments, which are most convincing. I can do no better than to quote him somewhat fully, and a study of this book will well repay any one. On page 197, he gives some concluding remarks, the gist of which are as follows:

"It may be deduced from the foregoing observations and experiments that diaphyseal bone is reproduced from the proliferation of osteoblasts derived from pre-existing osseous tissue, and that its regeneration takes place independently of the periosteum. The periosteum is not essential to bone production. Osseous tissue can pass through all the phases of its life, from its embryonic to its mature form, without the influence of or contact with this tissue. The periosteum is of great use in limiting within specific boundaries the distribution of the osteoblasts and preventing them during their evolutionary period from being scattered into the soft tissues, where they are prejudicial to the function of these parts. In the loose areolar tissue existing between the periosteum and the bone, the osteoblasts find nutriment for their growth and space to generate, free from undue pressure. While not under-estimating the periosteum as a limiting and protective

membrane, of great use in physiological and pathological conditions, there are no data to indicate that it can, of itself, secrete or reproduce bone. It has no osteogenic function. Bone, bereft of its periosteum, does not therefore die, and the mere detection of bare bone by a probe is no reason for believing that such bone is either dead or must die. If otherwise healthy, such bone is capable not only of living, but of performing its function and proliferating if need be."

A study of his experiments on this subject is thoroughly convincing. As to the origin of the osteoblasts themselves, he says on page 197:

"Diaphyseal osteoblasts are generated from the nuclei of the diaphyseal cartilage cells."

This is only a statement without sufficient proof, it seems to me. Throughout his book he makes no mention of either the endosteum or the marrow as affecting the growth of bone. I presume he intends one should infer that they have no influence on it. The endosteum is a distinct fibrous sheath lining the outside of the medullary cavity, just as the periosteum surrounds the outside of the bone. Between these two sheets of tissue the bone is laid down, and by them the form of the bone is determined. There is no bone formed on the inside of the endosteum nor on the outside of the periosteum unless they become broken and thus allow of the emigration of the osteoblasts through the break.

Baschkirzew and Petrow (*Deut. Zeit. fur Chir.*, Feb., 1912) publish the result of a number of animal experiments on the transplantation of bone. They confirm to a considerable degree some of the Macewen views. They declare (page 519) that, "Bones freed from periosteum transplanted into the soft parts prove themselves capable of regeneration. Periosteum is as little necessary for this regeneration as marrow." On page 524, they say, "there remains nothing else possible than to accept the view that the chief source of regeneration of bone, transplanted into the soft parts, lies in the primary layer of the granulation tissue which surrounds the transplant. The contact of the less living, and to the

greatest part gradually dying, bone seems to exercise upon this connective tissue a specific irritation and in high grade to further the metaplastic formation of bony tissue."

Macewen would probably amplify this by saying that the irritation is produced in the connective tissue by the osteoblasts poured out into it from the bone itself. Baschkirzew reports a successful case of transplantation of a patient's own fibula without periosteum into a defect in the ulna made for the removal of a sarcoma. The X-ray picture taken after four years showed that it had healed in perfectly but had not increased in size materially. Their conclusions are as follows:

1. The great majority of bone corpuscles soon die in free bone transplantations; some of them, which are stronger or which find themselves in particularly favorable nutritional surroundings, can remain a very long time living, until they finally die from actual exhaustion.

2. The transplantation of periosteum and marrow with bone is not unconditionally necessary for regeneration of bone transplanted into a muscle, since regeneration can take place without these parts. Even a large piece of bone free of periosteum and transplanted into a muscular position, also free of periosteum, is not necessarily absorbed; rather does it heal in and is replaced by new bone.

3. Autoplastic bony pieces are in respect to regeneration much to be preferred to homoplastic; destructive occurrences take place in them much less, while their replacement is much stronger and more complete.

4. "As chief source of the regeneration of bone transplanted into a muscle must be considered the young connective elements which grow around the bone, which press into all the marrow and vessel spaces, and which metaplaste into osteoblasts and bone cells.

5. "The transplanted periosteum and endosteum partly undergo necrosis. The remainder may be capable of regeneration and also produce new bone, but the permanency of this production is questionable and its separation from that which is produced by the connective tissue is often not pos-

sible. But in no way should the practical superiority of the periosteum covered transplant be doubted; the rôle of the transplanted periosteum is not yet cleared up, yet it is unmistakably useful; the quicker union of the transplant with its surroundings, the prevention of an all too quick resorption, the first cause of the new formation of bone are so many favorable conditions which the transplanted periosteum brings with itself."

Macewen in his book mentions the case of a boy, the whole of whose humeral diaphysis he was compelled to remove for necrosis. There was no subsequent osseous deposition. Fifteen months later he was readmitted with the request by the parents that the boy's useless arm be removed. Two wedges of bone were excised from another patient of six years of age affected with anterior curves. These were cut into minute fragments, quite irrespective of the periosteum, and were then deposited into the muscular sulcus in the boy's arm. There was no pus formation. Two months later a portion of new bone, an inch in length and three-quarters of an inch in thickness, was found firmly attached to the upper fragment of the humerus. Here all the grafts proliferated, grew to one another, and also to the extremity of the proximal portion. Two other wedges of bone of larger size than the first were similarly dealt with and inserted two months subsequently to the first graft, and a third couple were placed in position five months after the first. These all fused together and to the condyles of the humerus, filled the gap in the arm to the extent of four and a quarter inches. It is now 30 years since the humeral shaft was rebuilt, and during that period the man has depended upon his physical exertions for the earning of his living. He worked as a joiner for many years, and is now an engineer's pattern-maker.

A second case by Macewen is one in which the transverse ramus of one-half of the lower jaw was restored by transplantation of strips of a rib into the defect. A girl, 15 years of age, had the horizontal ramus of the lower jaw on one side extirpated owing to a diseased condition in childhood. An otherwise beautiful face was hideously deformed and saliva constantly trickled from the defect. It was resolved to try the effect of transplantation of bone, although the difficulty of securing asepsis so near the oral cavity was evident. The first step consisted in freeing, by an incision through the skin, the extremities of the ascending ramus of the jaw on the left side and the horizontal mandible on the right. This was difficult without opening the mucous membrane, as it was so closely adherent to the extremities of the atrophied bone. After this had been accomplished, a portion of a human rib, of size sufficient to fill the gap between the left ascending ramus and the middle line of the jaw, was removed subperiosteally, divided longitudinally into strips, and inserted into the gap in the soft

tissues and secured to the bones on either side, so as to keep the right mandible in its proper position. The soft tissues were then closed over it and the wound dressed, and it healed. One small portion of the transplanted bone became loose, and projecting against the scar was shed. The remainder lived, slowly augmented in volume until firm union between the ascending right ramus and the left mandible was secured. The overflow of saliva from the mouth ceased. It is now six years since this transplantation was done. The patient is perfectly well, and can use the mouth freely for mastication, having had a plate made which rests on the newly-formed jaw.

Vorschutz (*Deut. Zeit. fur Chir.*, Bd. cxi, Heft 4 and 6) transplanted into defects in the lower jaws of two patients grafts covered with periosteum taken from the tibia. The surfaces covered with periosteum were directed toward the mouth. In both cases the bones had to be removed subsequently because of abscesses. He tells of a case operated upon by Bardenheuer, who planted into a defect in the lower jaw a periosteum covered metatarsal bone. This had to be removed later because it formed an abscess. Vorschutz says that the periosteum should have been torn to allow blood to get to the bone.

Tomita (*Virchow's Arch.*, vol. cxc, 1908, p. 80) after a number of experiments gives these conclusions: New growths of bone come from the cells of the inner layer of periosteum and from the marrow cells. The cells of the bone itself have no power to form new bone.

Murphy (*Journal of the Amer. Med. Assoc.*, April 6, 1912) still further adds to the confusion which exists as to the growth of transplanted bone, yet his article is very instructive. He gives the following abbreviated rules on page 989:

1. The periosteum fully detached from bone transplanted into a fatty or muscle-tissue bed in the same individual, if he be young, may produce a lasting bone deposit; periosteal strips elevated at one end from the bone and attached to the other, if turned out into muscle or fat, reproduce regularly bone on their under surface for a greater portion of their entire length. This statement is rather contrafuted by a series of Macewen's experiments on page 38 of his book. He performed exactly the above experiments and found no bone in any of them. He goes on to say, "If the periosteum were raised, however,

with plaques of bone adherent to it, regeneration of bone would ensue from such pre-existing bone. Were one artificially or pathologically stimulating osteogenesis within the bone, the osteoblasts would be forced on to the surface of the shaft and become entangled in the meshes of the subperiosteal areolar tissue. Were the periosteum then removed, such osteoblasts would continue to grow and would give rise to the so-called periosteal formation of bone. In such a case, however, the process is the same as if the bone were removed from the shaft in bulk—it is the proliferation of the osteoblasts which has produced bone in either case, not the periosteum. In osteomyelitis one sees the same phenomena. Beyond the area of pyogenic invasion, the diaphyseal osteoblasts are regenerated in great number during the early period of inflammation in the medulla, and are extruded from the Haversian canals into the subperiosteal areolar tissue, filling the potential space between the bone and the periosteum."

2. Bone with or without the periosteum transplanted into muscle or cellular tissue in the same individual practically always dies and is ultimately absorbed. If this is so, then many of the remarks in this paper will prove to be impracticable. This does not agree with Macewen's experiments. Lack of space forbids me to quote him extensively, but I will cite one experiment which is found on page 97. Several transverse slices of the shaft of the right humerus, denuded of periosteum, were stitched to the omentum in the peritoneal cavity. Result six weeks afterwards: Certain portions of this intraperitoneal transplant showed evidence of absorption—and this was the predominating feature—while other portions had increased in bulk by the formation of new growth of bone. In one of my own specimens I excised one-half inch of the humerus and split it into two fragments. These I transplanted into the chest muscles of the same animal. Two weeks later the dog died of pneumonia. Examination showed that the two pieces of bone had healed into the muscles perfectly by primary union, and that they had become firmly united together by new bone. Macewen (page 93) placed two osseous shavings, bereft of periosteum, each about half an inch long and over one-sixteenth of an inch in breadth, in the intermuscular septa on the right side of the neck. In several weeks they were found to have grown into one dense plaque of bone, three-quarters of an inch long and fully one-quarter of an inch broad by an eighth of an inch in thickness, and the edges of the plaque showed evidence of active osteoplastic growth.

3. Bone with or without periosteum transplanted in the same individual and contacted with other living osteogenetic bone at one or both of the ends of the transplanted fragment always becomes united to the living fragments and acts as a scaffolding for the reproduction of new bone of the same size and shape as the transplanted fragment, if asepsis is attained.

4. The transplanted fragment, no matter how large or how small, is always ultimately absorbed. The rôle it plays is to give mechanical support to the capillaries and blood-vessels with their living osteogenetic

cells, as they advance from the living bone at both ends of the transplanted fragment into the Haversian canals, canaliculi, and lacunæ of the transplant. The graft is *per se* not osteogenetic but osteoconductive. The regenerative force and cells are supplied from the osteogenetic cells of the capillaries growing from the living bone. The graft, however, is an absolute necessity in the regeneration.

5. The graft increases in size on the surface as bone increases in size histologically, *i.e.*, by deposits beneath its newly formed periosteum.

This is not the Macewen conception of the growth of transplanted bone. On page 84, he relates the following experiment:

The greater part of the shaft of the radius with its periosteum was removed. The shaft of the bone removed, destitute of its periosteum, was then cut into very fine shavings and these shavings were placed between the muscles, which bulged into the gap left in the bone by the removal of the shaft. The neighboring muscles were then attached over the bone shavings in order to keep the shavings in position, and especially to prevent their being extruded from the wound. Examination of the specimen obtained seven weeks after operation showed that the continuity of the shaft was entirely restored. There was a marked increase in the diameter of the shaft opposite the part where the shavings had been inserted. All the component parts had become fused by osseous tissue into one another and both ends of the shaft. He says, page 91: "How much of the increase in bulk is to be attributed to the growth from the cut ends of the shaft, and how much is due to the proliferation of the individual osseous shavings, it would be difficult to apportion. But each graft, as seen in section, proliferates from its own centre. The vegetative capacity of the bone cells is as great as that of the epithelial cell, and if one grants not only the viability of the transplanted epithelium but also its power of extensive proliferation, then, judging by analogy, the bone cell ought to show, as it has done in this instance, equal capability of living and growing when transplanted. In proportion to the size of the graft, the smaller the graft the greater the proliferation. In the case of this osseous experiment, each graft has thrown out, peripherally, osteoblasts, which have formed round it a new area of bone. Thus every graft has formed a separate centre for ossific proliferation, and, in proportion to size, the smaller the graft the greater is the regeneration of bone. If the connective tissue, which takes the place of the periosteum after the latter has been removed and which gradually covers the grafts, showed any osteogenic function, as some believe, then it ought to have produced a uniformity in size of shaft whether the same amount of bone was divided into fragments or was left in one piece. That it does not do so is the fact against the putative osteogenic power of the connective tissue which takes the place of the periosteum, and also against the theory that the remaining diaphysis and not the transplants fill the gap."

I have myself transplanted ribs in the following two cases:

CASE I (Fig. 1).—A boy, twelve years of age, was operated upon by me November 19, 1910, for a large giant-celled sarcoma of the left lower jaw. The bone was divided about one inch to the left of the mid-line and was disarticulated at the joint. As a preliminary, however, the external carotid artery was tied. A number of small, discrete enlarged glands were removed from in front of the submaxillary gland and along the anterior border of the sternomastoid. I saw the boy from time to time thereafter. Never was there any sign of any recurrence of the growth. In February, 1912, the mother came to me and wanted to know if the depression caused by the loss of the lower jaw could not be filled in in some way, so the boy was readmitted to the hospital, and on February 10, 1912, just two months ago, I operated again.

An incision was made through the skin along the line of the old scar, and the dissection was carried upward very cautiously, taking great care not to open into the mouth. The finger of an assistant, in the mouth, was of great aid in preventing this. At the prior operation the cut edge of the mucous membrane of the tongue had been united to the cut edge of the mucous membrane of the cheek by plain catgut, so that there was very little tissue left between them which could be separated. Anteriorly the left vertical end of the lower jaw was separated from the mucous membrane, while posteriorly a channel was tunnelled in front of the external meatus. At no time was the mouth opened. A pattern of rubber tissue was taken of the length of rib necessary to fill the defect. The seventh rib was subperiosteally resected, without opening the pleura, by passing a Gigli saw anteriorly just external to its cartilage, beneath the rib, between it and the separated periosteum. The necessary length, as measured by the rubber tissue pattern, was separated from its periosteum and divided posteriorly by a rib shears. It was found that the rib could be easily pared by a knife. The anterior edge was shaved off so that it would overlies the lower jaw edge, which was scraped with a sharp spoon so that it would be fresh. Six holes were then bored through the body of the rib at various distances apart, so that nourishment could get into the interior of the bone. The anterior edge of the rib was then fastened to the lower jaw by a chromic gut suture passed

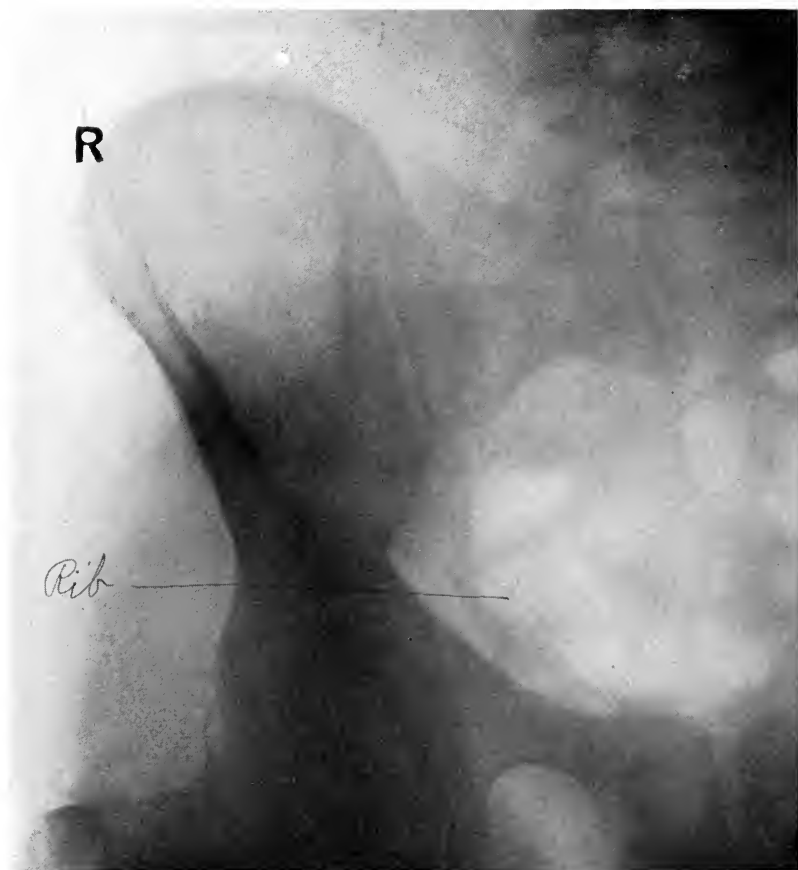
FIG. 1.



Rib

Rib grafted into a defect in lower jaw.

FIG. 2.



Rib grafted into inguinal hernia.

through a hole in the rib and to the fibrous tissue surrounding the lower jaw. Posteriorly the end of the rib rested in a cavity in front of and just above the external auditory meatus. The curve of the rib was just sufficient to fill in the curve of the cheek.

The boy did beautifully after the operation. The wound healed by perfect primary union. It is just two months since the transplantation. The rib has solidly united to the jaw in front, and there is as yet no sign of any breaking down. I should recommend in these resections of the lower jaw that apparatus be applied immediately after the operation to hold the resected jaw in position, and that the defect should be allowed to heal entirely before an attempt is made to transplant a rib into it.

CASE II (Fig. 2) was in a man of thirty-two years, who had suffered for some time from a reducible, moderate sized, left inguinal hernia. So confident was I from my first case of rib transplantation, and also from animal experimentation, that a rib would heal in perfectly in the tissues that I decided to strengthen the inguinal canal by transplanting a rib into it. This I did on February 19, 1912. The canal was opened, the sac isolated, transfixed, and amputated. I then subperiosteally removed four inches of a rib from his right chest in front, but found that it was too long, so cut about an inch of it off. The rib was then placed under or behind the transversalis tendon lying on the transversalis fascia, its internal end being held against the rectus muscle while its external edge was close up against the cord, which was slightly pushed outward by the rib. Prior to its being implanted, however, five holes were bored through the body of the rib so that nourishment would have better access to the interior of the implant. No sutures were used to hold the rib in position, as it remained in place without them. Over the rib the canal was repaired in the regular Bassini method, the cord lying on the internal oblique muscle, which was sutured to the deep part of Poupart's ligament by interrupted chromic sutures.

The X-ray picture (Fig. 2) shows the rib lying in the position in which it was originally placed. Time alone will tell how much the rib will increase in diameter. The wound healed by perfect primary union. There has been no irritation from its presence whatsoever.

This case is interesting because Murphy (*Jour. Amer. Med. Assoc.*, April 6, 1912) says, page 989: "Bone transplanted with or without the periosteum into the muscle or cellular tissue always dies and is ultimately absorbed." I shall be curious to see what becomes of the rib, since it has no contact whatsoever anywhere with bone—which Murphy maintains is so important for the viability of the graft.

I have conducted a number of experiments upon animals regarding the transplantation of bone, at the Surgical Research Laboratory of the College of Physicians and Surgeons. The results are not as yet complete, but some of them may be of interest.

The first specimen represents the perfect growing into a defect, made in the ulna of a cat, of two pieces of bone bereft of periosteum, taken from the same cat's humerus. They have also grown to each other. The cat was killed 52 days after the operation. The pieces were simply laid in the defect and the soft parts sutured about them.

A second specimen (Fig. 3) was also obtained from a cat. A defect, three-quarters of an inch long, was made in the radius, stripping off the periosteum first. A corresponding defect was created in the shaft of the humerus, and the radial piece of bone was laid, end to end, in the gap and fastened there by a wire passed through its medullary cavity and the fragments above and below. Into the radial defect was placed the piece from the humerus, being held there by simply suturing the soft parts over it. Plaster splint was applied, which was removed 72 days later and the animal killed. The specimen shows that the humeral graft into the radius was healed in perfectly, but is not absolutely solidified to the other fragments. The radial graft into the humerus became displaced but healed in perfectly solidly, its upper end becoming united to the side of the upper humeral fragment at least an inch and a half from its lower extremity, while its lower end became firmly attached to the upper end of the lower fragment. There was perfect primary union throughout in both wounds—the original dressing not being touched for nine weeks. This specimen illustrates how beautifully grafts will grow and thrive, even when deprived of their periosteum. The pathological examination of sections from both grafts follows:

PATHOLOGICAL EXAMINATION OF CAT'S LEG, SHOWING TWO BONE-GRAFTING
EXPERIMENTS (Figs. 4 and 5).

Gross Examination.—A. A section of bone 1 cm. in length from the humerus has been placed in an interval of the radius. The transplanted bone is surrounded by connective tissue. On manipulation of the transplant there is a slight degree of motion between it and the radius. The

FIG. 3.



Represents cat's foreleg. Into a defect in the radius was placed a section from the humerus without periosteum. This healed in perfectly. Into a defect in the humerus was placed the section from the radius without periosteum, and held there by a wire passing through the medullary cavity of the transplant and through holes drilled in each fragment. Plaster splint. Animal killed nine weeks later. Transplant from humerus into radius had healed in perfectly, notwithstanding its size being greater than the defect. Marked deformity of the humerus fragments. The transplanted radius section had become attached solidly to the side of the upper humeral fragment one and a half inches from its extremity, while the lower extremity of the radius transplant was firmly united to the upper extremity of the lower fragment. See microphotograph.

FIG. 4.

New bone

Gap with
osteoid tissue

Humerus



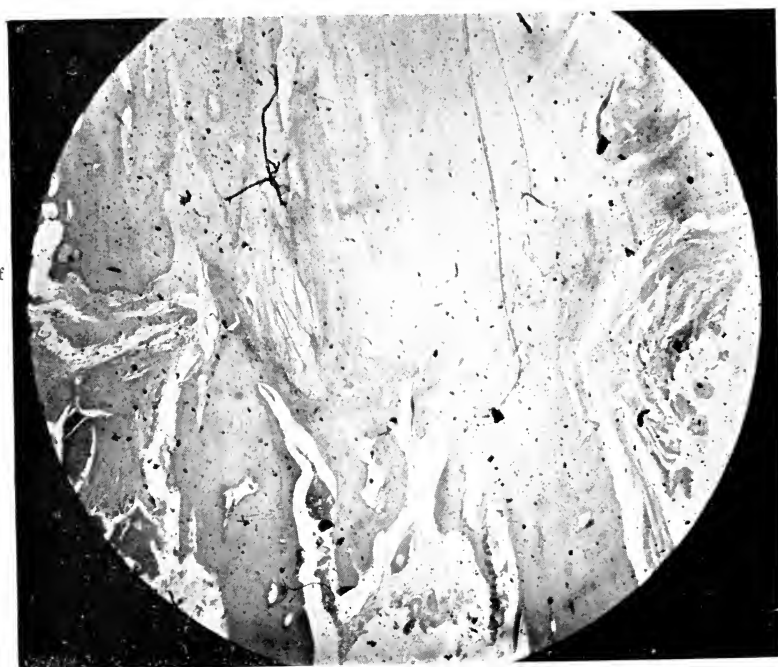
Line of
union

Line of
union

Radius transplant. The graft is undoubtedly alive, and is not being replaced by bone from the neighboring old bone.

FIG. 5.

Humerus

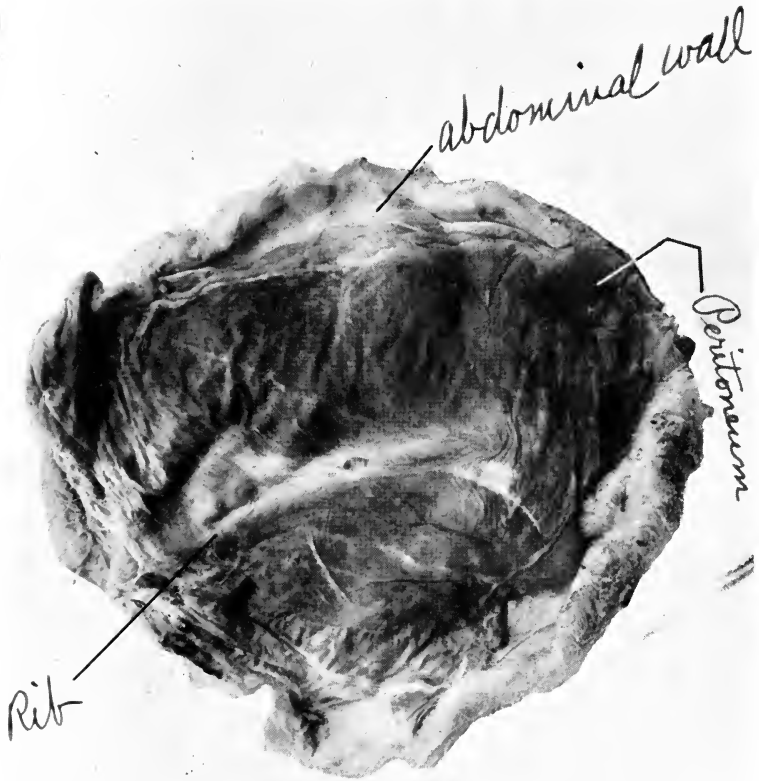


Line of
union

Line of
union

Medulla of radius graft.

FIG. 6.



Illustrates perfect healing in of a rib, deprived of periosteum, transplanted into abdominal wall, just superficial to peritoneum. Rabbit died three weeks after operation from some unknown cause. Primary union.

FIG. 7.



Specimen showing that bone is reformed from bone itself. (Specimen kindly loaned by Dr. Bancroft.) Periosteum cut away from median surface of a humerus at a considerable distance from the bone section. Defect then cut in the humerus. Thorough curetting away of endosteum and marrow. Packed to stop oozing. Cavity injected with sterile olive oil. Soft parts then sutured over cavity. Twenty four days later, animal killed. Autopsy showed that the cavity made in the bone was irregularly filled in by new bone, the medullary cavity being quite closed in by new bone. The periosteum can be seen ending at quite a distance from the cavity, and cannot be thought to have had anything to do with the new formation of bone. Only by supposing that the endosteum had reformed, could it have had anything to do with the new bone. The new bone must then have come from the bone cortex itself.

line of junction between the fragments is distinct and is surrounded by connective tissue.

A longitudinal section shows that the cortices of the bone are in close apposition, but are separated by a thin line of soft tissue.

Microscopic examination shows the graft *in situ* between the cut ends of the radius. The ends of the graft are irregular, but in their entirety suggest the even cut ends of the original transplant. The ends of the radius show fibrillated fibres and new osteoid tissue presenting from the trabeculæ of the medullary cavity.

The graft itself at points shows small cavities (Howship's lacunæ) in the trabeculæ, and in one there was an osteoblast; but at many other points there are small projections of undoubtedly new osteoid tissue reaching out into the interval of soft tissue between transplant and radius and growing from the graft itself.

There is no actual bone union between the fragments, but in the interval of fibrous tissue there are many areas of forming bone. At one point only in the section of the graft are there any great numbers of osteoblasts along the bone trabeculæ. The graft is undoubtedly alive and forming new bone, and is not being replaced by bone from the neighboring old bone.

B. Gross examination of transplant in the humerus shows that the lower fragment is out of alignment with the upper, and is joined by an interval of solid bone extending obliquely from one fragment to the other.

There is no false point of motion between the bone and graft.

Microscopic examination (Figs. 4 and 5) shows proliferating masses of osteoid tissue, and cartilage—a so-called callus—between the graft and sides of original bone. This new-forming bone is small in extent, since the fragment had been in close apposition. There are many osteoblasts along the bone trabeculæ of the graft—evidence of bone growth. In other words, the transplant is alive, forming new bone, and united by osteoid tissue to the original or old bone.

Another specimen (Fig. 6) is that from the abdominal muscles of a rabbit, which died from some unknown cause three weeks after a rib had been subperiosteally removed from his chest. This was scraped free of any trace of periosteum and then transplanted into the abdominal wall. The rib healed very kindly into the tissues. I am having microscopical sections made of a portion of this tissue to see how the healing has taken place. I have a second rabbit, in whose abdominal wall I have transplanted four ribs taken from another rabbit. All the ribs were scraped carefully clear of periosteum, and were then placed transversely across the upper part of the abdomen, under the skin. It is now 46 days

since the operation. The wound healed by primary union, and there has never been the slightest irritation in it. One can feel the ribs in the abdominal wall.

In a dog, which is still living 50 days after the operation, I transplanted a rib deprived of periosteum into the abdominal wall after it had been split into four longitudinal strips, each strip being about one-quarter inch from its neighbor. There is no sign of any irritation, the union being by primary union. I wish to determine by these experiments whether or not such grafts will live and how much growth we may expect to get from bone deprived of its periosteum and transplanted. I wish to determine whether or not it is feasible to transplant one or more ribs into the human abdominal wall with the hope that the rib or strips of rib may proliferate and increase in size, and that thus we may possibly have a means of curing some intractable abdominal hernias.

Suppose that we transplant strips of a rib, say a quarter of an inch apart, in front of a hernia. If the strips would throw out a bony sheet and become united together, there may be another means of curing some of these hernias. Transplanting a rib or ribs would be certainly preferable to implanting a silver filigree plate. Implanting a sheet of fascia, however, may prove superior to any other method of curing these hernias.

Another specimen (Fig. 7) has been kindly loaned me by Dr. Bancroft, to whom I extend my thanks. It proves fairly conclusively that bone is reformed from bone itself, irrespective of periosteum, or endosteum, or marrow. On January 21, 1912, he incised the median surface of a humerus in a dog and cut the periosteum away for 3 cm. He then cut a defect in the bone, extending into the medullary cavity, 0.8 by 0.6 cm. Thorough curetting of the marrow and endosteum was then done. The cavity was then packed so as to make it perfectly dry, following which it was filled with sterile oil and the soft parts were then sutured over the cavity. Twenty-four days later the dog contracted distemper and was therefore killed. Examination of the operated humerus, after it had been hardened in formalin, showed that the cavity made in the bone was irregularly filled in by new-formed bone, the medullary cavity being quite closed in by this new bone. The periosteum can be seen ending at quite a distance from the cavity, and by no stretch of the imagination can one think that it had anything to do with the

formation of new bone. Likewise with the endosteum; only by supposing that it had been reformed could one say that it had had any influence on the new bone. The new bone must, then, have come from the bone cortex itself.

While experimenting with the transplantation of ribs in animals, an idea occurred to me which I proceeded to try out on dogs: It is, to use a rib as an intermedullary splint in cases of fractures upon which one feels obliged to operate, in this way getting rid of the necessity of using a Lane's plate, which is a foreign body. That such a transplanted rib will grow in perfectly I hope to prove in dogs. I have now operated upon 17 dogs, removing sections of varying lengths from their humeri. The marrow was spooned out of each fragment of the humerus. Into the medullary space of the upper fragment was placed a rib, and through the upper fragment and the rib a hole was drilled through which a wire was drawn and its ends twisted together. In my earlier experiments I simply placed the rib in the medullary space without wiring it, but subsequent examination showed that the rib worked its way up or down in the space, and thus it became displaced and deformity resulted. It is only necessary to fix the rib in position at one end, the other end going into the medullary cavity as far as one can manage to make it go. A rib may be shaved with a knife to any desired size. It is a particularly favorable graft because it is not dense bone, hence is less liable to die and more likely to amalgamate with its surroundings. A rib may be made to fill in a defect in the bone to any extent, the space between the fragments being bridged in by the rib. Osteoblasts, I believe, will be thrown out, not only by the rib but also by the ends of the fragments, and thus the space between the bones will become filled in. In my next case of fracture in the human that I open up, I purpose trying this method instead of using a Lane's plate. In the human, I believe that chromic gut would be sufficient to hold the rib in position, and thus one would do away with the use of any foreign substance, which would be a great advantage. Of the 17 dogs that I have thus

operated upon, in five I have transplanted ribs covered with periosteum into defects created in the humeri, while in 12 I have used ribs without periosteum. I hope thus to determine what influence the periosteum has on such a transplant. I believe that in such a case the periosteum will be disadvantageous. Its presence will limit the emigration of osteoblasts from the surface of the graft, in addition to keeping the blood from the graft. Sufficient time has not elapsed as yet to tell what the results of these experiments will be.

Another thing which will furnish keen interest in observing is the difference we will find in the reformation of the excised rib in the two cases—one in which the periosteum has not been removed with the piece of rib, and the other in which it has. My expectation is that in each case there will be an almost equal production of bone coming from the ends of the fragments, but that in the case in which the periosteum has been removed the new bone will be irregular and may just as well as not unite with the upper or lower rib, as that the defect between the ends of the rib be bridged over, since there is nothing to give guidance and direction to the osteoblasts coming from the ends of the defect. I believe that the periosteum in itself has nothing to do with the new formation of bone, *i.e.*, with the production of osteoblasts, its main function being to concentrate the spread of the osteoblasts arising from the bone itself along definite channels, thus giving accurate form to the bones. I may say that I have been surprised at finding, on autopsy in animals, how accurately the periosteum which had been entirely removed previously is replaced by a sheet of connective tissue, which by the naked eye cannot be told from normal periosteum.

In another dog I excised two pieces of periosteum from the humerus and transplanted them into the chest of the same animal. Twenty-seven days later the dog was killed in a fight. At the autopsy the periosteum in the chest could not be found, certainly there was no new formation of bone about it.

In two dogs I have produced fractures, in one both bones of the foreleg, in the other of the humerus. After five days I have cut down upon these fractures and have spooned out the exudate about

the fractures and have transplanted this exudate into the shoulder muscles of other dogs. Both dogs are still living, so that I cannot tell as yet about the new growth of bone, or whether or not there is any

In two other dogs, following Macewen's experiment, I have created defects in a bone of the foreleg, removing the periosteum as thoroughly as possible, and over the ends of the bone I have placed a continuous glass tube. By this I hope to exclude any possibility of the periosteum having any influence on the growth of new bone. One of the dogs is still living, it being now 43 days after the operation; the other died from some unknown cause on the twentieth day after the operation. The fore-leg had perfectly healed by primary union. The glass tube was filled with blood-clot. A microscopical examination is being made of the ends of the bone.

In another dog I subperiosteally resected two ribs. This is very easy of accomplishment. This left two broad sheets of periosteum. These I excised separately and then transplanted them into the abdominal wall of the same animal. It is now three weeks since this was done, and as yet I can feel no new bone in the position of the transplanted periosteum.

I have had no success whatsoever in transplanting joints. I have transplanted the elbow-joint (all three bones with the joint unopened) from one dog into another 12 times. The operation is technically easily possible. I have also transplanted the head of the humerus from one dog into another 10 times. All these dogs died either from sepsis, necrosis without sepsis, distemper, pneumonia, or empyema. This was in the beginning of my experimental work, which may account for the heavy mortality. It taught me, however, a number of things. One is, that the iodine preparation of the skin does not produce sufficient sterility of the field. The method of sterilization I now use is as follows: removal of the hair by barium sulphide the day before operation; soap poultice to the operative field for three hours before operation; at the operation, thorough friction of the field of operation by green soap, then ether, and finally, by Harrington's solution. Then again I now exclude the skin from the operative wound rigidly by fixing towels by sharp clips to the cut skin edges. It was also some time before I learned how to put a plaster-of-Paris bandage on the dogs so that it would hold them, yet without causing ulcerations of the skin. This is exceedingly difficult to do. I have lost a number of dogs

simply from infected ulcerations distant from the operative wounds, due to excessive pressure.

With the experience thus gained I shall do these joint transplantations over again, and shall hope for better success next time. More than usually careful asepsis is necessary. I may say that dogs are more easily infected than human beings, hence greater precautions are necessary.

As a result of my studies and experiments, I should like to ask the following question: Is the attitude of almost all operators in maintaining the necessity of transplanting a graft, covered with as much periosteum as possible, correct? For example, in transplanting a graft taken from the tibia, one is advised to retain the periosteum on two of the three sides of the graft. Is there not a distinct disadvantage in doing this, because the periosteum prevents ready access of blood to the bone? Would it not be better to remove all the periosteum and to drill holes through the graft so as to assure the best blood supply to it possible? In several of my cases in which I had transplanted a periosteum covered rib into a defect in the humerus, the animal died after two or three weeks for one or another reason. Examination of the transplanted ribs showed that there was no periosteum left on the grafts. It had necrosed away. Until we definitely and conclusively decide what part the periosteum plays in the production of bone, it seems to me that we must more or less be working in the dark.

Then, again, is it better to transplant into a defect, say in a long bone, one single fragment, or would it not be better to shave the single fragment into small pieces and transplant these? Macewen has had great success with this latter method.

In looking over the literature it has been a constant surprise to me to find that so little use has been made of a rib as a graft. The ninth at about its middle is quite thinly covered with muscle, and can be very easily shelled out of its periosteum. It is richly supplied with minute nutrient foramina, which afford an effective means of nourishment for the

bone when transplanted. It is a bone which may be used to advantage when it is necessary to transplant bone to supply defects in the long bones, the bones of the skull, etc., or where it is necessary to supply bone to make up for a loss of the bony framework of the nose. Carter (*Medical Record*, Dec. 9, 1911) has transplanted a rib into the nose in nine cases and in no case has it necrosed. His description of the operation is as follows: A curvilinear incision (convexity downward) about three-fourths of an inch long is made down to the bone over the nasofrontal process. Through this incision the skin and subcutaneous tissues over the dorsum and sides of the nose are elevated with a long, thin, two-edged knife, curved on the flat. Above this incision the periosteum over the nasofrontal process is elevated for about a quarter of an inch. About two inches of a rib is subperiosteally removed and this is then split longitudinally. All the medullary tissue is then scraped from the outer half. If this is left it has been found that it causes irritation and an aseptic fever, the graft being more apt to slough out. The strip of rib is inserted into the wound in the nose previously made for its reception, the lower end reaching nearly to the tip of the nose and the upper end being carefully anchored under the periosteum over the nasofrontal process. The transplantations were done 18 months ago (two cases), 1 year, 8 months, 7 months, 5 months, 4 months (three cases). In none of them is there any sign of disappearance of the graft or any irritation.

My thanks are due to Dr. Joseph A. Blake for many valuable suggestions, to Drs. Clarke, Bancroft, and Whipple for pathological examinations, and to Drs. Wheelwright and Jameson for very efficient assistance in the operations.

AN UNUSUAL SINUS FRONTALIS.

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THE unusual frontal sinus which presents the subject for this brief note was found on the right side of a white, male cadaver, aged approximately fifty-five years.

In the large series of heads previously studied for the substance of my earlier papers ¹ on the nose and the paranasal chambers, I encountered many and marked variations in the size, shape, type, asymmetry, and duplication of the frontal sinus. The exhaustive studies of Turner,² Cryer,³ and others also demonstrate the great range in variations in the adult frontal sinus.

It is a well-known fact that the frontal sinus is in a large percentage of cases not a simple chamber. It is frequently more or less divided into subcompartments or recesses by incomplete bony partitions. We also often find a duplication or even a triplicity of the frontal sinus on one or both sides, each cavity communicating independently with the nose. Often ethmoidal cells project into the frontal region and are occasionally classed as frontal sinuses. Variations as to number and manner of communication with the middle nasal meatus are readily explained by the genesis of the frontal sinus.⁴

Notwithstanding the many and marked variations previously observed by the writer, the frontal sinus which

¹ Univ. of Pennsylvania Med. Bull., vol. xxii, 1909; Amer. Jour. of Anat., vol. x, 1910; Anat. Record, vol. iv, 1910; Jour. of Morphol., vol. xxi, 1910.

² The Accessory Sinuses of the Nose, Edinburgh, 1901.

³ Studies of the Internal Anatomy of the Face, Phila., 1901; Jour. Amer. Med. Assoc., vol. xlviii, 1907.

⁴ J. Parsons Schaeffer: Jour. of Morphol., vol. xxi, 1910.

FIG. 1.



Unusual sinus frontalis.



presents the subject for this note varies essentially from those studied before. The unusual character of the sinus in question and the importance of the variation from a surgical aspect justify a note on its anatomy as a matter of record.

In the illustration accompanying this note we have a reproduction of a ventral view of the dissected frontal sinuses (right and left). The left sinus presents nothing unusual. It has a small bridge of bone ventrally and superiorly protruding into the lumen of the sinus. The sinus extends dorsad over the orbit for 34 mm. and laterad for 35 mm., but it does not project far into the squama frontalis—the major portion of the left sinus occupying the pars orbitalis of the frontal bone. It is, however, extensively developed medial to the orbit and toward the middle nasal meatus, so that there is no naso-frontal duct (infundibulum of the frontal sinus). The sinus communicates directly with the middle nasal fossa by two ostia, one opening into the frontal recess of the middle nasal meatus and the other into the ventral and superior termination of the ethmoidal infundibulum.

The right sinus is, however, much more complicated. It is shown in both the large figure (ventral view) and in the small figure to the left (sagittal view) in the accompanying illustration. The plane of section of the sagittal view is indicated by the dotted line *X-Y* in the larger figure.

The dissection showing a ventral view of the right sinus presents a more or less typical cavity. It projects beyond the midsagittal plane to the left—a very common variation. Its greatest transverse measurement is 50 mm. and the greatest ventrodorsal measurement is but 10 mm. It does not extend to any appreciable degree over the orbit, but projects far into the squama frontalis. In these respects it contrasts strongly with the left frontal sinus.

On the dorsal wall of the right frontal sinus, as shown in the ventral view in the larger figure, immediately lateral to the line *X-Y*, at point *B*, is noted a round ostium, about 2 mm. in diameter. This ostium led to the finding of the

large accessory sinus immediately dorsal to the normal sinus illustrated in the dissections herewith reproduced. Careful dissection demonstrated a large accessory frontal sinus communicating with the right frontal sinus proper, through the small aperture *B*, shown in both figures. In the small figure to the left, sagittal section through the right frontal sinus, is revealed the accessory frontal sinus or large diverticulum from the sinus proper, dorsal in position. A reference to the figure will show the outline of the accessory frontal sinus passing well over the orbit, beneath and dorsal to the right frontal sinus proper. It will be noticed that three plates of bone intervene between the soft tissues of the forehead and the dura mater: first, the plate (1) ventral to the right frontal sinus proper; second, the plate (2) dorsal to the sinus proper and ventral to the accessory sinus; third, the plate (3) dorsal to the accessory sinus, and forming the ventral boundary of the anterior cranial fossa (*F* in the figure designates the anterior cranial fossa).

The accessory frontal sinus measures 37 mm. in its greatest transverse dimension and 30 mm. in its greatest ventrodorsal extent. It projects somewhat into the squama frontalis, and extends well dorsad in the pars orbitalis of the frontal bone.

The frontal sinus proper of the right side communicates with the frontal recess of the middle nasal meatus, indicated by the black arrow (the middle nasal concha, *C*, is partly cut away so as to expose the frontal recess). The ethmoidal infundibulum (*E*) ends blindly in an anterior ethmoidal cell. The large accessory frontal sinus of the right side communicates with the frontal sinus proper through the ostium marked *B* and indicated by the white arrows in both figures.

Had the right frontal sinus proper, as shown in the large figure, been opened surgically in the living subject, the large accessory sinus, dorsal in position, would in all likelihood have been entirely overlooked. The natural inference would of course have been that the bony plate marked 2 was the

plate separating the frontal sinus from the dura mater and brain. A reference to the sagittal section demonstrates the fallacy of such a conclusion.

In concluding this note we may offer a word as to the genesis of this large diverticulum from the right frontal sinus proper. There is all evidence in the specimen that the right frontal sinus proper had its genesis in an anterior ethmoidal cell, which in turn had its genesis in one of the frontal furrows on the lateral wall of the frontal recess of the fœtus (see previous paper referred to in footnote 4). The ethmoidal cell continued its development sufficiently to become topographically the right frontal sinus. The natural inference is, since all of the paranasal chambers are primarily outgrowths from preformed nasal spaces, that some time during the further development of the right frontal sinus, a dorsal evagination from the sinus grew into the plate of bone which separated the right frontal sinus from the dura mater. The evaginated sac continued to grow and the bone immediately surrounding the sac was resorbed; the two processes, growth of the sac and resorption of bone, taking place *pari passu* with the further growth of the sinus proper. In this manner the large accessory cavity was formed dorsal to the sinus proper. The plate of bone marked *B*, although very thin, not being entirely resorbed, remained as a partition, completely separating the two cavities, save at the point of the original budding of the accessory right frontal sinus; the point of the origin of the sac, of course, remaining as the ostium of communication between the two cavities in the adult.

BILATERAL CONGENITAL FISTULÆ OF THE LOWER LIP.

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AFTER a fairly complete review of the literature of the subject about two years ago, I was able to find only one similar case,¹ and until recently, could obtain from embryological experts no adequate explanation of the causation of this unusual deformity. Dr. G. C. Huber, the Professor of Histology in the University of Michigan, at first confessed his inability to explain the condition, but finally suggested the following theory which seems to be the correct one. On either side the well-known median notch seen to persist for some time during intra-uterine life after fusion of the two halves of the lower lip has been completed, it is not unusual to detect a slight secondary notching on each side. This Huber believes to become deeper, its deepest portion becoming gradually buried until a short tubular tract lined with mucosa is formed. Why this fixation of the deepest portions should occur, permitting the normal depth of the lower lip to develop, is of course conjectural.

Two cases of this condition in members of the same family have recently come under my notice. The father, one brother, and a sister are alleged to have presented the same anomaly, but not having had the opportunity for a personal examination, I am not prepared to vouch for the accuracy of the observations. The maternal grandmother of these children had both harelip and cleft palate, the mother cleft palate but no harelip, while an aunt had cleft palate, but two uncles had no such deformities.

¹ Goldflam: Münch. med. Wochenschrift, Jan. 8, 1907.

FIG. 1.



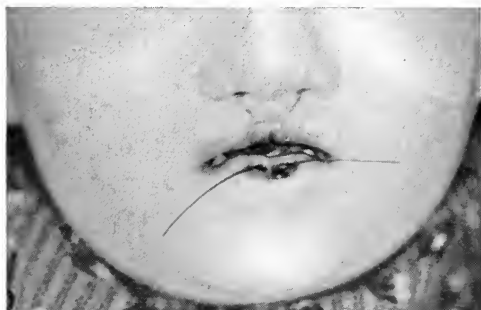
Fistulæ of the lower lip.

FIG. 2.



Bilateral congenital fistulæ of the lower lip.

FIG. 3.



Bilateral congenital fistulæ of the lower lip.

FIG. 4.



Bilateral congenital fistulæ of the lower lip.

CASE I.—Male, aged three years (Figs. 1 and 3), entered the surgical service of the University of Michigan with double harelip and complete cleft of the hard and soft palates.

CASE II was a girl aged four years (Figs. 2 and 4) presenting an unilateral cleft of the lip on the right side with a complete defect of hard and soft palates on the same side.

In both patients the lower lip is slightly notched in the median line with a depression on each side leading to a narrow track too small to admit an ordinary probe, but readily admitting a coarse piece of silkworm gut as seen in the illustrations. These tracks gave vent to a small amount of clear mucus when manipulated.

Both cases were operated on successfully by Drs. Darling and Lyons, in the Oral Division of the Surgical Clinic, both the lateral and oral defects being successfully dealt with while the fistulæ were not treated.

NOTE ON INTRATHORACIC SURGERY: DIVISION AND CIRCULAR SUTURE OF THE THORACIC AORTA.

BY WALTER M. BOOTHBY, M.D.,

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(Boston).

THE success of intrathoracic surgery is dependent on the care that is given to the apparently unimportant details of the operation, including the preliminary preparation and the post-operative stage, and the method of anæsthesia. The majority of these details are common to any operative procedure within the thorax, and therefore, notwithstanding that the following technic has been evolved for a particular operation, the points herein made have a general application.

In a recent article Dr. Cotton and I have at some length entered into the advantages of intratracheal insufflation anæsthesia and our methods of avoiding the dangers thereto. Therein we laid little stress on the injury to the lung tissue itself by overdistention from undue air pressure, but strongly pointed out other grave dangers of an excess of intrapulmonary pressure. In experimental work on the smaller animals, which have very delicate tissues and in which the thorax is widely opened, the dangers incident to injury of the lung itself increase in importance. Accordingly throughout the operation the anæsthesia must be of such depth that spasm of the glottis is at least unlikely to occur; furthermore the safety-valve must blow off at a pressure not exceeding 6 mm. of mercury. If attention is not given to these points, the alveoli on the surface of the lung will break through and air may be seen bubbling out of the tissue.

If the anæsthesia is relatively deep, the glottis can (in the cat) be seen to be widely dilated even up to the size of the trachea. Accordingly a larger volume of air can be used

without an increase in the intrapulmonary pressure, and in consequence more air currents are produced in the bronchi resulting in better aëration. If, however, the blood becomes cyanotic, an occasional intermittence of the air current as advised by Meltzer and Auer will immediately remedy the condition. Furthermore this low pressure allows the lung to be easily retracted and walled off by a silk sheet from the dangers of the operative manipulations without the use of undue force.

The prevention of infection from the dirty skin and fur is of particular importance in animal work. Soap and water must not be used, because the animal cannot under anæsthesia be in a wet condition throughout a serious operation without evidencing marked symptoms of immediate shock from loss of body heat; besides, this wet condition subjects them to the almost invariable complication of post-operative pneumonia. The use of the iodine method appears to me perfunctory, and in consequence I have not used it.

The following technic is simple and positive, as an extensive use has proved. While the anæsthesia is being induced by the cone to allow the introduction of the tracheal tube the hair for an extended distance around the proposed incision is closely cut; by means of a brush merely dampened in water the short cut hairs are removed. After the tube is introduced the animal is draped with towels and "lap" sheet as in human work. The desired skin incision is made, if possible with one clean sweep, and the knife discarded; the skin is then undermined for one inch all the way round. Immediately thin silk is folded over the edge and carefully tucked way up where it had been undermined and securely clamped there by the use of the Bachaus towel clamp. By this means the question of skin infection is entirely eliminated, as everything in the operative field is absolutely sterile.

An efficient dressing cannot be applied to an animal, therefore we omit it entirely. To prevent superficial wound infection after the operation the cat is placed in a wooden box with cover, which is raised from the floor by short legs; the bottom

of the box is made of heavy wire netting over which is spread clean cotton waste. The cat is left in here two days, when the wound is practically safe from infection; the animal is then put in a large open cage. The box is scalded out with hot water from a hose after each animal.

Since using the above method of protecting the pleural cavity from infection by hair and dirt from the skin, no case of post-operative pleurisy has developed, whereas in our experience such infection had been common after intrathoracic operations; the clean box has prevented entirely superficial wound infection.

An intercostal incision properly made gives ample room for the easy carrying out of most every procedure within the thorax. To do this, however, the incision must extend from the sternum or costal ridge in front to within half an inch of the head of the rib behind, and this necessitates the division of the erector spinæ muscle. No perceptible weakening of the back results from this if reasonable care is taken in suturing this muscle. On rare occasions it may be necessary to divide one rib. A mouth gag acts as an efficient rib spreader.

After the rib spreader is in place, the lung is gently pushed out of the way and protected by a silk sheet. Great care must be used to prevent undue pressure on the delicate lung tissue. The aorta will now be seen running down the left side of the posterior wall of the thorax; the left sympathetic nerve with its small ganglia can be seen coursing down beneath the pleura about a third of an inch externally; at the level of the sixth intercostal space the thoracic duct lies between the sympathetic nerve and the aorta very close to the latter, and can usually be seen superficial to the intercostal arteries. Just mesial to the aorta the posterior division of the mediastinal pleura runs forward; it is very thin, and the opposite lung can be seen shining through; at its base is the œsophagus, and in the cephalic end the trachea and bronchi; on the posterior division is seen the pneumogastric nerve coursing down behind the root of the lung. Still more anteriorly lies the heart

with the phrenic nerves plainly visible lying between the mediastinal pleura and the pericardium passing in front of the root of the lung. The division between the two pleural cavities is made complete by the reflexion of the pleura from the pericardium to the anterior wall of the thorax, and here again the opposite lung can be seen shining through this very thin transparent membrane. The mediastinal walls are so thin and delicate that they with their entire contents make wide excursions (when one pleura is opened) with each respiratory movement.

To free the aorta the thin pleura and connective-tissue layer overlying it is divided for a distance of three inches by fine scissors, care being taken not to injure any of its branches. If a small vein crosses the aorta it should be double clamped before division (crushing is usually sufficient, as its size rarely warrants a ligature). Then by means of a fine blunt dissector introduced through the incision in the pleura and connective tissue just made, close to the aorta itself, the latter can be readily freed without danger of injuring the thoracic duct or opening the opposite pleural cavity. By continuing the blunt dissection and gently separating along the intercostal branches of the aorta, the main trunk can be sufficiently freed so that it can be lifted up from the posterior wall into the wound more than an inch, thus rendering it very easy to work upon. As a rule it will be found unnecessary to clamp and divide any of the intercostal arteries.

When the aorta is adequately freed, and this should be carefully done in order to render the succeeding manipulations easy, the clamps are applied. Formerly I used two, one above and one below the intended division; now I place a second one above the division, for occasionally one will slip off; the resulting hemorrhage though readily controlled is distinctly to be avoided. The exact placing of these clamps (either the Crile clamp with pressure regulated by a screw or the old fashioned serrefine may be used) is important; the two between which the division and suture are to be performed should be placed as far apart as possible, and yet if possible

remain in the interval between two intercostal arteries, thus obviating any annoyances from reflux of blood from the collateral circulation. So placed, not less than half an inch should separate the two and thus leave ample room for suturing; however, if necessary, do not hesitate to ligate and divide one or more intercostal arteries. The third clamp is placed in the space immediately above the intercostal artery below which the preceding proximal clamp had been placed. Before applying the clamps see that your stay and circular sutures are all ready for immediate use and that everything else is in the best possible shape, in order that the interruption of the circulation may be as short as possible. Time spent in preliminary work to render everything easy is well worth while.

In applying the stay and circular sutures the technic I now use, with the following special warning requisite for the thoracic aorta, is the same as that recently described by me in conjunction with Dr. Ehrenfried.¹ The temptation of attempting to deliver the vessel too freely into the upper part of the wound by tension on the stay sutures must be avoided; the aorta readily tears and large holes are thus easily made; the two mortalities in this series are directly attributed to this cause, for the attempt to close the holes resulted in the occlusion of the vessel lumen. It is only rarely possible to close such a tear with success.

Instead of silk I now use No. 200 cotton; it is smoother, stronger, and threads more easily; it just fits a No. 15 Kirby needle. The thread needed is wound on small squares of cardboard and sterilized in white liquid petrolatum.

The proper way of removing the clamps is first to remove the distal one; the reflux of blood will reveal any large tears that have been produced by undue tension on the stay sutures; these unless very small should be closed by a separate suture. Remove the extra clamp and then slowly open up the remaining clamp; this should be done gradually in

¹ ANNALS OF SURGERY, liv, 485-495.

order to allow the small needle holes to fill up with clot. A little oozing is to be expected, but if there is no large tear the proper removal of the clamp will decrease the amount of blood lost to about a drachm. If all the clamps are removed quickly, the immediate throwing of high blood-pressure against the needle holes results in an unnecessarily great loss of blood before the leakage stops.

The closure of the thorax presents no difficulties; two or three stay sutures encircling the ribs adjacent to the incision are placed and tied fairly snug, thus pressing the intercostal tissues together; the superficial muscle layer is closed air-tight by a neatly applied continuous suture with one additional mattress suture in the erector spinæ muscle; the skin is also closed by the continuous suture. As soon as the ribs are brought together by the tying of the stay sutures the air pressure is increased sufficiently to completely distend the lung and to maintain it so while the wound is being rendered air-tight by pressure over the trachea. All ligatures and sutures (except for blood-vessel work) are of fine Pagenstecher; no catgut is used.

About two years ago in conjunction with Dr. Ehrenfried we conducted quite a series of intrathoracic operations for the express purpose of working out some of the details above mentioned; it was elementary work and our mortality was excessive.

Recently I have had opportunity, among other blood-vessel operations, to carry through a series of six experiments in which the descending thoracic aorta was completely divided and reunited by circular suture according to the technic above described. Our results were encouraging, for out of the six operations four recovered; a mortality of only $33\frac{1}{3}$ per cent. The deaths were due to obstruction of the lumen in unsuccessful attempts to close extensive tears made by the stay sutures. The four that recovered were on the next day walking about the cage in evident excellent condition; at the end of a week they were running and climbing about the large cage in perfect health.

In one animal that recovered (much to our surprise), the thoracic duct had been injured, and throughout the operation this was continually leaking out large amounts of clear lymph. It is interesting to note that a division of the thoracic duct is not necessarily fatal, probably through an unknown collateral circulation.

SUMMARY.—By following out certain details of technic herewith described the mortality following the operation of division and circular suture of the thoracic aorta can in cats be reduced to at least $33\frac{1}{3}$ per cent. Injury of the thoracic duct is not necessarily fatal.

NOTE ON THE TRANSPLANTATION OF FRESH VENOUS SEGMENTS.

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IN attempting to transplant kidneys it is essential to be able to quickly and accurately perform a double suture of a venous segment. We found this particularly difficult on account of the thinness of the vein, for after its division and removal it completely collapses and curls up on itself, and it is almost impossible to introduce the stay sutures; after the stays are placed it is easy.

To overcome this difficulty I carried out a short series of experiments in which one-half inch of the vena cava was removed and implanted in the aorta. No difficulty arose from the obstruction of the inferior vena cava. The following method of placing the stay sutures has obviated all difficulties, and therefore seems worthy of separate record.

After the vena cava is freed for a distance of two inches a ligature is applied at the upper and lower ends. Close to the upper ligature the vein is grasped on the top side by a pair of smooth forceps; a small nick is made close to where the forceps grasp the vein; immediately a stay suture is passed through from behind the forceps from without into the lumen of the vein and emerging at this nick; the second stay is placed on the lateral posterior side in the same way, also emerging through this nick; the third is placed on the opposite lateral posterior side and likewise emerges through the same hole. In like manner the three stay sutures are placed at the other end of the segment. Each stay as soon as placed is clamped by a mosquito forceps to keep it in place and prevent its needle from falling off. When all the stays

are placed, the division of the vein is completed and it is transferred to the place prepared for it in the aorta. Each stay is then rapidly placed in its appropriate position through the wall of the aorta from within out, and, after they are all placed, tied. The circular suture then proceeds ordinarily and without difficulty.

If the venous segment is to be inserted into another vein, the latter should not at first be completely divided like the aorta, but should only be nicked and the stays introduced through the small hole just as described for placing in the segment, except they must be made to pass from within out; when the stays are placed the division of the vein is completed.

The implantation of a fresh venous segment can by this technic be rapidly and safely performed.

THE RESULTS OF LIGATION OF ONE URETER.*

BY LOUIS FRANK, M.D.,

AND

LEON BALDAUF, M.D.,

OF LOUISVILLE, KENTUCKY.

(From the Pathological Laboratory of the Medical Department of the University of Louisville.)

THOSE engaged in abdominal and pelvic surgery during the period of its development will recall the fear of an accidental ureter ligation, and those familiar with the earlier textbooks on gynæcology are familiar with the dangers so graphically described as following this accident. It was firmly believed for a long time that such accidental ligation of one ureter was followed within a short time by the death of the patient, and we will recall such statements expressed in medical societies as: "To ligate a ureter is necessarily fatal;" "Doubtless many cases go to the grave as a result of a ligated ureter"; and, "Were the causes of all our deaths actually known, ligation of a ureter would frequently be found to have produced many of them." These were the accepted opinions until eight or ten years ago, when the pendulum swung the other way and it was for a time thought that the accident occurring unilaterally was followed by no bad effects whatsoever. Some six or seven years ago Dr. Robert T. Morris stated that ligation of one ureter was followed by absolutely no ill consequences, that the kidney ceased to functionate, and underwent atrophy.

The statement emanates from one of the large surgical clinics in this country that in seven different cases one ureter had been intentionally ligated for the purpose of getting rid of the kidney, the patients each suffering from accidental

* Read before the Southern Surgical and Gynæcological Society, Washington, D. C., December, 1911.

injury of a ureter and consequent fistula. This statement bears out the generally accepted opinions to-day as to a single ureter ligation, and it seems that we have been convinced that the result of this surgical accident is far from being a fatal one, and that practically the only effect is the physiological loss of the kidney on the affected side.

Personally we have never so far as we know ligated a ureter during the course of an operation, so we can only speak from the experience gained as a result of our experimental work. Nor has the one of us engaged in pathological work ever seen this accident at the autopsy table, notwithstanding our work for some years past has given us ample opportunity for a large number of post-mortem examinations.

During the past summer in connection with some other work we were doing in the Pathological Laboratory of the University of Louisville, we began a series of experiments to determine, if possible, what did actually take place as a result of the ligation of one ureter. The observations made were in many respects quite interesting and by no means uniform in regard either to the end result or the condition at any given time subsequent to our ligations. While our work is not completed, it is sufficient to enable us to arrive at some definite conclusions and has gone far enough to enable us to present some few facts at least.

The experimental work along this line heretofore has been largely from the metabolic side and has been carried out almost entirely upon guinea pigs and rabbits. Our work has been from the clinical and pathological stand-point. In a study of the effects of ligation of one ureter upon the kidney and upon the animal, it has been shown by Amos, Bainbridge, and Beddard that the renal tubules continue to secrete urine and that Heidenhain's view as to the functions of the kidney is in all probability the correct one; their experiments decidedly indicate that the secretory activity of the tubules is rapidly impaired by ligation of the ureter, whereas the glomeruli are more gradually involved. Even two months after ligation the kidney can still secrete some water and some nitrogenous material.

The rapid flow of urine occurring immediately after opening the ureter is doubtless analogous to that observed clinically under similar conditions. It can hardly be the result of increased secretory activity on the part of the kidney, since this organ subsequently yields much less urine than the normal kidney of the same animal. It may be suggested, as a conjecture, that the sudden alteration of pressure on the damaged glomerular epithelium allows purely physical factors to act unchecked and that the first rush of urine is formed by simple filtration through the glomeruli.

Bainbridge concludes:

(1). Ligation of one ureter is followed by hydronephrosis of the kidney.

(2). There is a temporary loss of weight followed by complete recovery, no ill effects are noticeable two months after the ligation.

(3). The initial pressure of the urine is low and bears no relation to the blood-pressure.

(4). The secretory power of the kidney, as evidenced by its capacity to secrete water and nitrogenous constituents, steadily diminishes after ligation of the ureter, but is not lost at the end of two months.

(5). No absorption (that is, any evidence of it) was obtained when KI was put under a pressure of 50–80 mm. Hg into the renal pelvis.

Orth found following ligation there occurred dilatation of the tubules, flattening of the epithelium, and changes in Henle's loop. Immediately following ligation the pressure of urine upon the veins of the pelvis of the kidney brings about a state of hyperæmia and hemorrhage, particularly under the capsule and in the connective tissue. After two or three days anæmia succeeds hyperæmia and ultimately atrophy develops. The pressure of the stagnant urine in the ligated ureter and pelvis of the kidney causes an œdema of the organ extending to the capsule and surrounding connective tissue. This œdema is due to the reabsorption of the watery elements of the urine by the lymphatics, and of course disappears when secretion ceases.

Lepine and Poeteret found by experiment that the secretion of urine ceases as soon as the counter-pressure in the pelvis of the kidney amounts to 50 mm. of mercury.

Cohnheim showed that a 50 mmHg pressure is necessary to arrest the flow of urine. When an obstruction takes place gradually, the walls of the ureter lose their tone, so that the largest hydronephrotic sacs are those brought on insidiously or experimentally, which give the stagnant urine time to exercise mechanical dilatation of the walls, while with a sudden closure there is a distention of the kidney and ureter which very soon disappears. The stout elastic capsule of the kidney and the resorptive function of the lymphatics are forces which contribute largely toward the reduction in size in these latter cases of sudden complete obstruction.

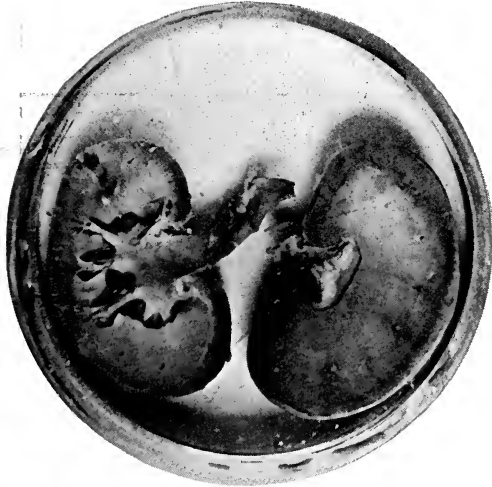
Straus found in his experiments, using 20 guinea pigs, that four or five months after ligation there was a high grade hydronephrosis with atrophy of kidney and disappearance of pyramids. Histological examination showed atrophy collapse of tubules, shrinkage of epithelium, cystic widening of the Malpighian corpuscle, and thickening of capsule and blood-vessels. There was compensatory hypertrophy to nearly double the size in the other kidney. Five of his experimental animals died of peritonitis.

We find a report of only one clinical case in the English literature, this being a translation from the German of Landau's case. Landau cites three operators, Bastianelli, Futh, and Phenomenow, who had carried out the procedure which he reports, namely, ligation of the ureter for the relief of accidental urinary fistula. He says in his report:

"It is now seven months after the operation, and the patient has made a good recovery in spite of the fact that for three days she vomited and had a violent headache, and that the urine was lessened to half the amount for two weeks. Up to this time there have been no symptoms of hydronephrosis. The cystoscopic examination shows the right kidney to be functionless, the orifice of the right ureter appearing on the bladder wall as a small dimple."

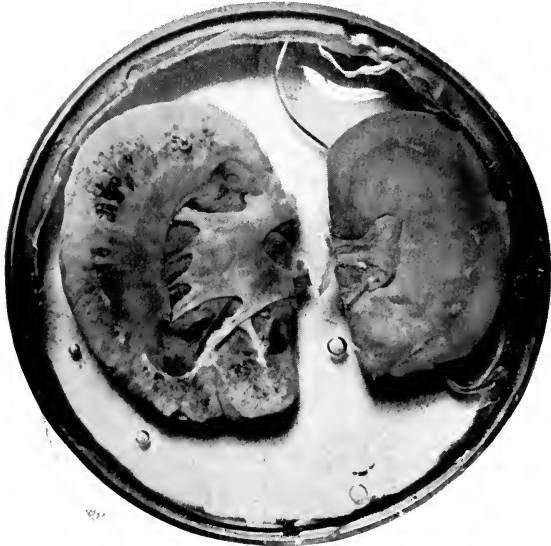
Our experiments were carried out on dogs. The technic consisted of ligating the ureter with Pagenstecher yarn close

FIG. 1.



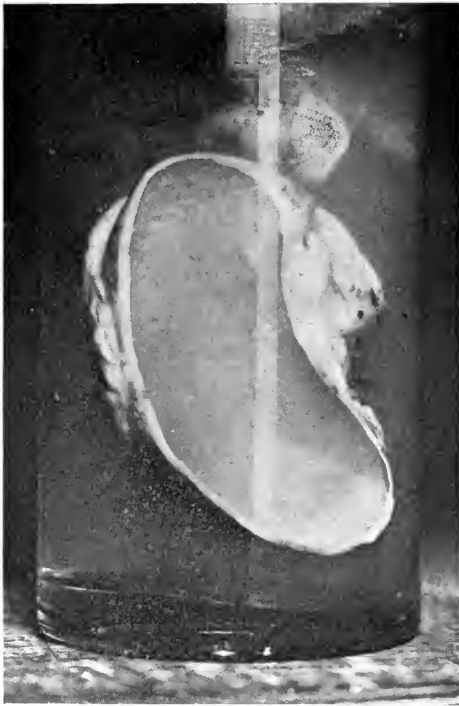
Experiment 3. Marked hydro-ureter; abscess of kidney; staphylococcus infection. Kidney shown to right from unligated side.

FIG. 2.



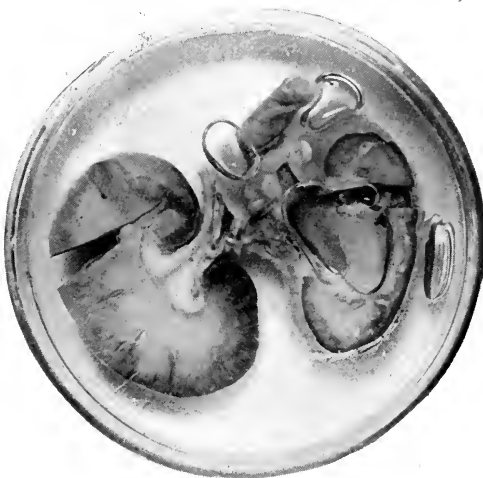
Experiment 8. Enormous hydro-ureter. Miliary abscess of kidney, particularly the cortex. Kidney shown to right from unligated side.

FIG. 3



Experiment 32. Enormous pyelonephrosis. Kidney 3 inches in diameter. 5 inches in long axis.

FIG. 4.



Experiment 33. Hydro-ureter, atrophic kidney. Compensatory hypertrophy shown in kidney to right, which is from the unligated side.

to the bladder. The posterior layer of peritoneum is left intact if the ligation is done low down. Some of the earlier dogs were tied high up, but this necessitated a search and division of the posterior parietal peritoneum and was abandoned after four or five applications. In tying low down no handling of intestines is required, and usually three to five minutes suffice to complete the entire operation. Dogs Nos. 2, 4, 5, 21, and 30 died as a result of operation. The others were destroyed in from two hours to two months after application of the ligature, and not only were the symptoms studied during their life, but the post-mortem condition was noted, and in many, bacteriologic examinations were made of the urine in the pelvis of the kidney and in the bladder. Those dogs showing abscesses in the kidney were also studied in part from the bacteriologic stand-point, showing a staphylococcus present as a constant finding. This organism was the only one found in the urine in those instances in which a bacterium was present.

The specimens from dogs Nos. 3, 8, 32, and 33, as seen in the accompanying illustrations, show the different changes we have observed. Each specimen is shown with the normal kidney, namely, the kidney from the unligated side of the same dog.

In Experiment 22, we tried to simulate the happenings of an accidental ligation and division of a ureter during the course of an operation, using, however, non-absorbable ligature for purposes of identification and to enable us to surely relieve the constriction after one week. The results in this case are extremely interesting. Only a few of the animals appeared sick or at all affected, which is in keeping with what usually happens. However, it must be noted that in Experiments 3, 5, 8, 18, 31, and 32, abscess formation was noted in the kidneys. This is probably in keeping with the work of Brewer as shown in his Chairmanship address before the Surgical Section of the American Medical Association. It is clearly demonstrated by him we believe, and generally accepted, that kidney infections occur through the blood channels, the organ as a result of injury becoming a *locus minoris resistentiæ*,

permitting bacterial lodgement and development. Ligation of or sudden obstruction of a ureter which is complete, even though existing for a few hours only, may do the same thing. When the obstruction exists as long as two or three days it may result in abscess formation, while if the absolute obstruction be continued, it may eventuate in a large pus kidney. Such a pyonephrosis is noted in Experiments 31 and 32, the latter being shown in Fig. 4. Experiment 31 presented an exactly similar condition of the kidney and also had present when destroyed a suppurating femur which had begun as a swelling about two weeks earlier, the swelling rupturing with purulent discharge a week later, *i.e.*, a week before destruction. This dog had an extensive osteomyelitis, doubtless of embolic origin from the suppurating kidney. Animals 28 and 33 are still living and will be studied at a later date.

We think the œdema in the perinephritic tissue is also worthy of note, and believe with Orth that the secreted urine is probably reabsorbed in this way, that is, through the lymph channels.

Constant were the dilatations of the peripheral veins—showing a very probable anastomosis of the renal vein with the adrenals and the intercostals. This is noted in some of the protocols.

Shortly after ligation there is a distinct hydro-ureter with hydronephrosis. This is usually present at the end of two hours. The kidney is very much enlarged, weight (opened) greatly increased. At first there is a distinct venous congestion, and on section of kidney considerable amount of blood escapes. Later this bluish tinge of the kidney disappears and is replaced by a marked dilatation of peritoneal veins, which represents the anastomosis between vessels of the kidney and the adrenal, also of the renal with probably an intercostal vein. At the end of 24 hours a marked perinephritic œdema is visible. After two or three days this disappears. The cortical tissue of the kidney after the initial venous congestion is thickened and distinctly paler.

It would seem from our experiments that in from 10 to 15

per cent. of the ligations such gross and extensive changes in the kidney have taken place as would have required in man further surgical operation to relieve, but the animals have gone on and lived without apparent discomfort. An atrophy occurs without such gross and extensive surgical change in the kidney in from 80 to 90 per cent. of those cases in which the ureter has been ligated. It is definitely proven that ligation of the ureter is an accident that is not to be absolutely disregarded, and it is a bad procedure to ligate a ureter to get rid of the kidney (Nierenausschaltung).

The detailed protocols of the series of experiments are omitted in this publication but will appear in full in the *Transactions of the Southern Surgical and Gynæcological Society* for 1911.

CONCLUSIONS.

1. Ligation of one ureter is followed by a primary hydro-ureter and hydronephrosis, which results in ultimate destruction of kidney function as a result of pressure atrophy of the secreting tubules.

2. Not infrequently infection and suppuration of the kidney may follow ligation of its ureter, due to lessened resistance in the kidney as a result of circulatory changes.

3. The microscope shows very strikingly that the greatest effect histologically is exerted upon the tubular structures and that the glomeruli are only slightly involved as a result of the fibrous deposits accompanying atrophy. (This will be the subject of further study.)

4. Pyelo- and pyonephrosis may occur from hæmatogenous infection in such kidneys, leading to their complete destruction functionally and anatomically.

5. Experimental animals may present no apparent symptoms though suffering from marked hydro- or pyelonephrosis. This may possibly be true in man as regards subjective symptoms.

6. Embolic septic processes may ensue following hæmatogenous kidney infections though the latter present no apparent symptoms.

7. The ligation of the ureter for the purpose of eliminating the kidney or its function (Nierenausschaltung) in the presence of ureteral fistula or the accidental ligation of a ureter is not without danger, and under such conditions if restoration of the lumen of the ureter is impractical or impossible, nephrectomy should be the procedure of choice.

8. Ureteral fistulæ are sometimes spontaneously cured by cicatrization and occlusion of the ureter and secondary atrophy of the kidney.

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ON APPENDIX TUMOR.

BY F. E. McKENTY, M.D., F.R.C.S. (Eng.),
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AN article appearing in the *Bulletin of the Royal Victoria Hospital*, Montreal, entitled "Primary Carcinoma of the Appendix,"¹ revealed the remarkable fact that no case of primary carcinoma of the appendix had occurred previous to 1906. The six cases which were described in the *Bulletin*¹ referred to occurred between that date and July, 1911. One month later two other cases had come to operation. The fact that no cases were discovered during the first 14 years of the hospital's existence and that so many occurred within a comparatively small number of subsequent years cannot be explained on the assumption that the number of carcinoma cases is increasing, but rather that more careful examination and to a certain extent the practice of earlier and more frequent operation interferences with appendix and general abdominal conditions have allowed of their detection. The comparative frequency rather than the comparative rarity of these cases, together with their peculiarities as regards clinical history, etiology, and histology, is sufficient reason for reporting additional cases and briefly reviewing the literature on the subject.

CASE I.—Mrs. C., aged thirty, was complaining of pain in the right lower quadrant, which had come on suddenly a month before admission and was associated with vomiting. Tenderness was elicited only on deep pressure over the appendix. There was no history of loss of weight. At the operation a slight amount of serous fluid was found in the abdomen, and nothing unusual was noticed.

Appendix: Macroscopical Examination.—The organ was two and a half inches long, and had a fatty mesentery. The diameter

¹ A full review of the literature is given in this article.

was the same throughout, there being no swelling at the distal end. The serous membrane was slightly congested. The walls were of normal thickness, and the lumen was obliterated at the distal end by what was apparently a swollen mucosa of deep yellow color. There were no concretions or evidence of adhesions. The swollen mucosa seemed to be marked off from the rest of the lining by a faint line. The normal mucosa was much paler.

Microscopical Examination.—The cross sections showed that the mucosa was replaced entirely by a fibrous tissue, which stained pink with eosin and possessed a very cedematous appearance.

Lying in spaces within this stroma there were large tongue-like masses of cells, which shrunk away from the margins of the spaces in which they lay. The larger masses were nearest the submucosa and the smallest in the centre of the appendix, where the stroma was more abundant than at the periphery. This arrangement, however, was not uniform, for in some places small acini with abundant stroma were visible at the periphery also. The larger acini had columnar cells at the periphery, the smaller ones showed no distinction of this kind. The cytoplasm of the cells stained feebly, and in many cases there was vacuolar degeneration; such degeneration probably accounted for the lumen occasionally seen within some of the masses. The blood-vessels were numerous and had fairly thick walls. There was uniform eosinophilia. The remaining coats of the appendix were perfectly normal.

The longitudinal sections showed swelling of the mucosa, a moderate grade of inflammatory-celled infiltration in the interglandular tissue, with marked eosinophilia, and in the lowest parts, a typical obliterative appendicitis; that is, abundance of fibrous tissue, absence of glandular tissue, thickening of vessel walls, development of fat spaces among the fibrous tissue, and generalized inflammatory-celled infiltration. The nodule of growth was so small that the removal of the affected portion for transverse sections left no tumor tissue for longitudinal section.

CASE II.—F., aged twenty-six, was admitted, complaining of pain in the right lower quadrant, which had existed on and off for three years. The pain was in the lower abdomen and colicky in character, lasting from a few minutes to an hour, then disappearing. During these attacks, sometimes in the interval,

the patient complained of loss of appetite and full feeling, and eructations of gas. She spent five months in a sanatorium for a slight tuberculous lesion in the apex of the right lung, but very little evidence of this was found on admission to this hospital. The day before admission there was a sudden attack of pain, with nausea, vomiting and rise of temperature, which continued all day. The appendix was removed the following day.

Macroscopical Examination.—The appendix was 12.5 cm. long. Its diameter was normal up to a short distance from the tip, which was slightly enlarged. Immediately proximal to this distended portion there was a small spot of gangrene opposite the mesenteric border. The serosa was congested throughout and covered with lymph. The lumen was patent to the point of perforation. The distal part was plugged with a soft œdematous, dark, sloughy material. In this region the wall was thick and firm. The mucosa in the rest of its extent was of a dark red color and covered with blood-stained fecal matter.

Microscopical Examination.—Low power: The lumen was obliterated by a plug of very œdematous fibrous tissue, in which there was a considerable amount of coagulated lymph and a moderate round-celled infiltration. Lying in spaces of varying size were large collections of cells completely filling them. The central parts of these masses frequently showed some evidence of degeneration, as was evidenced by poor staining properties and absence of nuclei. In other places the whole mass was degenerated. The inner circular muscular coat of the appendix was remarkably free from these cell nests, while the outer muscular layer showed very large masses with well-formed cells. The circular arrangement of the muscle fibres seemed to prevent free growth. These masses extended to just underneath the serosa, which showed marked proliferative peritonitis. Eosinophiles were few in number.

A study of the individual cells showed them to possess a large amount of pale pink cytoplasm and to be of low columnar or spheroidal shape. The nuclei were oval, rounded, or in some cases almost spindle shaped; they stained very deeply and no nucleoli were seen in them.

These cases coincide in their general clinical and histological appearances with the forms usually described.

Etiology.—The etiology is as obscure here as in other

cases. One would expect that new growth of the appendix would be of very common occurrence, because here we have all the following known etiological factors favoring the development of tumor:

1. Irritation: Perhaps in no other part of the body is there an organ or tissue so likely to show signs of chronic inflammatory processes as the appendix. It is striking to see how few of them show signs of carcinoma. In all the cases of carcinoma of the appendix which have been met with at the Royal Victoria Hospital, Montreal, and in the majority of those described in the literature, there is usually considerable evidence of chronic inflammatory change, as is shown by the increase of fibrous tissue in the walls, going on to complete obliteration of the lumen. This increase of fibrous tissue may be explained in more ways than one. Some would look upon the inflammatory processes as primary, leading to cutting off of the cells of the mucosa—the new growth taking place at a later date. Favoring this theory, there is the fact that this condition occurs at an age when inflammatory processes in the appendix are common, *i.e.*, between twenty and thirty years. But this condition also occurs frequently before these obliterative changes could occur. Cases have been recorded at as early an age as five years.

2. From an embryological or developmental stand-point, the appendix presents a great deal of interest. By some it is looked upon as an involuting structure—a relic of our remote ancestors; by others, as a developing structure gradually increasing in importance in order to subserve some more modern requirements in our economy. In other words, we have here a likely place for displaced cells to occur which could form the starting point for new growth.

The position of these tumors further bears out this theory. One may say that they are invariably found at the tip, where developmental changes are most likely to be marked. Again, the histological picture of these tumors, differing as it does from that seen in other parts of the intestinal tract arising

from Lieberkühn's follicles, being embryonic in appearance, leads one to think that the process of the cutting-off of cells is an early one rather than one occurring at such later times as when the cells have completely developed. Further, the character of the fibrous tissue does not resemble that of an ordinary inflammatory process as much as it resembles that seen in the tissue of a scirrhus carcinoma. It is a well-known fact that when we have epithelial tissue growing into a stroma there is usually a marked proliferation of the connective tissue in the part (up to obliteration of the lumen). This is, perhaps, one of nature's methods of protecting herself, and these obliterative changes, which are always noticed in cases of carcinoma of the appendix, may be the cause or at least one of the reasons why this tissue grows so slowly and shows so few of the signs usually attributed to disease of the alimentary tract.

Why such cut-off cells should cease to remain dormant is that, perhaps, they are stimulated to growth in some instances by the onset of the inflammatory processes which are so frequently met with in the appendix. Variations in the character of the tumor may possibly be due to an association of both series of circumstances.

Age and sex have a very important significance in etiology. The age of incidence is usually between twenty and thirty, and the explanation of this seems to be that, as suggested, inflammatory processes stimulate the growth of epithelium, or, again, that the abdominal operations, during which many of the tumors have been discovered accidentally, are more frequent at this age than in earlier life.

In about 70 per cent. of cases the condition is found in the female, and in the majority of these is discovered as an accidental condition in operations on the pelvic organs. This is perhaps explicable on the same grounds as those suggested for age, namely, that, according to some authors, there is a difference in the lymph and blood supply of the appendix²

² Quain's Anatomy.

in the female which renders it more resistant to inflammatory processes and permits the tumor to grow before it is obliterated by the acute inflammatory process which renders it more liable to develop. Concretions in the appendix and the length or position of the appendix seem to have no bearing on the etiology.

If all these factors are present so frequently, why is not malignant growth more common? There is no doubt that more careful examination of all appendices would show a considerable increase in the number of cases. The cases that have been discovered are those where the growth has been slow, and in many instances where our suspicion has been aroused owing to the enlargement of the appendix. It takes very little to disturb the normal condition of the appendix, and this overgrowth of the epithelium disturbing the lymphatic and circulatory apparatus may initiate an acute inflammatory process, with gangrene, sloughing of the distal extremity, and abscess formation, and it is not hard to realize how very difficult it would be, in this mass of necrotic material, to discover the remains of a tumor which at its best is only the size of a small bean, and which in one of our cases was found to be entirely separated from the appendix proper and was accidentally wiped out of the wound with a gauze sponge.

Association with Pulmonary Tuberculosis.—Pulmonary tuberculosis has been said by Letulle and Weinberg to exist frequently with carcinoma of the appendix. The literature in general does not bear this out, and here at the Royal Victoria Hospital many patients suffering from pulmonary tuberculosis, who have been sent to us from St. Agathe and Saranac Lake, have been operated on, showing tuberculosis of the appendix without any evidence of tuberculosis in other parts of the abdomen. In only one instance was there any evidence of cancerous growth (Case II).

The History of the Condition.—In many cases nothing is seen but a slight congestion of the serosa. The appendix is normal in appearance. On opening the appendix, the lumen

at the tip may be obliterated for a short distance by a small plug of what appears to be yellowish swollen mucous membrane. Again, a small tumor is frequently present, never larger than a bean. The serosa over it is intact, and on section cuts firm and is of yellowish color. Again, when the inflammatory processes have been acute, the tumor mass may be separated from the extremity or become gangrenous, destroying all traces of its existence.

Various forms have been described, the predominant one being that composed of spheroidal cells, and various modifications in the arrangement of the cells have led investigators to place them under one of our known classifications—scirrhus carcinoma, adenocarcinoma, colloid carcinoma, endothelioma. Kelly, commenting on these peculiar tumors, remarked upon their similarity to basal cell carcinoma which Borst also called an endothelioma. The clinical history of these tumors, together with the fact that the lymphatics of the appendix are widely invaded, and that, at the same time, it does not tend to spread beyond the appendix and involve other areas (the literature does not show one case where a bona-fide appendix tumor produced metastases or involved glands far from the root of the appendix),—the clinical history and growth of these tumors resemble better those seen in endothelioma, but the histological picture is widely divergent. It seems that it is a tumor by itself with all its own peculiarities, and as such deserves a special name and place in our classification.³

Symptoms.—Frequently there are none, the condition being discovered accidentally at the postmortem or during some other operation. It may simulate either chronic or acute appendicitis. Symptoms that are its own are wanting. We have no evidence here of loss of weight or cachexia, as is so frequently an early sign of malignant disease occurring in other parts of the intestinal tract.

³ It is of interest to note the similarity to this class of tumor presented by certain cases of carcinoma met with in the ileum and described as "carcinoid tumors." (Simmonds, Gruner and Fraser, Frankel.)

Prognosis.—The only sure thing about this peculiar tumor is that on its complete removal the patient can be promised freedom from recurrence.

Treatment.—Removal of the appendix.

The chief features of the condition are: (1) comparative frequency; (2) peculiar liability to female sex; (3) early age incidence; (4) absence of metastases; (5) peculiar histological arrangement; (6) chronic course; (7) cause, origin in embryonic remnants.

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FOREIGN BODY APPENDICITIS.

WITH ESPECIAL REFERENCE TO THE DOMESTIC PIN; AN ANALYSIS OF
SIXTY-THREE CASES.

BY ROYALE HAMILTON FOWLER, M.D.

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THE origin of appendicitis a few years ago was frequently attributed in the lay mind to the influence of foreign bodies. Grape seeds, strawberry seeds, orange pips, and other bodies figured conspicuously. Now, however, we know that true foreign bodies are rarely found, and that concretions play a subsidiary rôle in the production of the disease. Records show that seeds are rarely found in the appendix; heavy objects drop in with the greatest ease. Since the demonstration of the nature of fecal concretions and the recognition of the fact that they are not true foreign bodies, but the result of inflammation rather than the cause, little attention has been paid to the subject of foreign bodies. If careful chemical and physical tests are made, analysis will show that certain bodies which have been considered seeds are nothing more than fecal concretions. A justifiable scepticism has arisen concerning the accuracy of observation in such cases. If the foreign body is completely surrounded by fecal matter its presence may be easily overlooked. True foreign bodies have been found free and unencrusted in the appendix or in an abscess cavity into which they had escaped. In the majority of cases foreign bodies have been found either partially or completely surrounded by fecal matter. In a limited number of cases shot have been found in the appendix without surrounding fecal matter and without, it is stated, evidence of inflammation in the organ. Fragments of egg-shell, enamel from saucepans, etc., have been found in appendices in which it was stated the organs were apparently normal. Without microscopic examination the detection of foreign body inflammation is not possible. A foreign body may set up very little irritation and may not be active in causing an acute inflammation until it is surrounded by fecal

concretion. According to some authorities a foreign body cannot enter a normal appendix. It is reasonable to suppose that a foreign body may cause irritation and an increased production of mucus, which is deposited upon the body, producing a concretion. The presence of a foreign body in the appendix seems more apt to cause a chronic than an acute inflammation, and indirectly an acute exacerbation.

Statistics showing foreign bodies in general as predisposing causes of appendicitis present considerable variation. Up to 1906, foreign bodies had been found by the late George Ryerson Fowler¹ in $\frac{1}{3}$ of 1 per cent. of 2000 cases. Murphy² found foreign bodies in 2 per cent. of 2000 cases, and Mitchell³ in his study of 1400 cases found them to be present in 7 per cent. Other observers, Fitz⁴ and Matterstock,⁵ found

TABLE SHOWING PER CENT. OF FOREIGN BODIES,
EXCLUSIVE OF ENTEROLITHS.

| No. of Cases. | Foreign Body. | Per cent. of Foreign Body. | Reported by | Year. |
|---------------|---------------|----------------------------|--------------------------------------|-------|
| 1400 | 98 | 7 | Mitchell ³ | 1899 |
| 152 | 18 | 12* | Fitz ⁴ | 1886 |
| 169 | 20 | 12* | Matterstock ⁵ | 1880 |
| 429 | 14 | 3.5 | Renvers ⁶ | 1895 |
| 106 | 3 | 3* | Kraft | |
| 67 | 0 | 0 | Hawkins ⁷ | 1895 |
| 2000 | 40 | 2 | Murphy ² | 1904 |
| 200 | 1 | 0.5 | Galland | |
| 460 | 23 | 0.5 | Kelly, A. O. J., Deaver ⁸ | 1905 |
| 1000 | 4 | 0.4 | Kelly and Hurdon ⁹ | 1905 |
| 200 | 15 | 7.5 | Ferguson ¹⁰ | 1891 |
| 2000 | 1 | 0.2 | Fowler, G. R. ¹ | 1906 |
| 459 | 16 | 3* | Ranvier | |
| 1000 | 5 | 0.5 | Bell | |
| 250 | 1 | 0.4 | Robb | |
| 103 | 2 | 1* | Ochsner ¹¹ | 1899 |
| 100 | 2 | 2 | Morris, R. T. ¹² | 1895 |

* About.

¹ Fowler, George Ryerson: *Treatise on Surgery*, Saunders, 1906.

² Murphy, John B.: *Journal American Medical Association*, Sept., 1904.

³ Mitchell, J. F.: *Johns Hopkins Hospital Bulletin*, 1899, vol. x, p. 35.

⁴ Fitz: *Trans. of Association of American Physicians*, 1886, vol. i, p. 110.

⁵ Matterstock: *Gerhardt's Handbuch der Kinder Krankheiten*, Bd. 80, vol. i, 1880, vol. v, p. 893.

them in about 12 per cent., the former studying 152 cases and the latter 169.

In the post-mortem examination of 3750 subjects at the Cook County Hospital, the appendix was found by Heineck¹³ to contain foreign bodies in but two instances. Two cases came under William Osler's¹⁴ personal observation in the course of ten years of pathological work in Montreal. In general terms it may be said that appendicitis due to irritation and trauma from foreign bodies does not represent more than 2 or 3 per cent. of all cases. We are justified in looking upon the swallowing of certain kinds of foreign bodies with grave solicitude until they are located and removed.

Sharp, pointed metallic foreign bodies represent a class by themselves. They have rarely been found even in large surgical experience, and their occurrence represents a surgical curiosity. The common domestic pin is the most frequently encountered body of this nature found in the appendix. It is the most dangerous. McBurney and Park have seen but two cases. Abbe, Dawbarn, Deaver, Kammerer, Keen, Mayo, Ochsner, and Syms, each have seen but one case. A. O. J. Kelly found but one instance in a study of 460 cases, Kelly and Hurdon but one in 1000 cases and Bell two in 1000 cases. Ewing, Schultze, and Wood¹⁵ in exceptionally large pathologic experience have observed no cases in which pins were found in the appendix. Barnes,¹⁶ in a study of 94 cases of true foreign bodies found in the appendix, estimated that more than 52 per cent. were pins. The writer observed one instance in his first series of 50 cases of appendicitis. The

⁶ Renvers: Festschrift der Frederick Wilhelm Institut., Berlin, 1895.

⁷ Hawkins: Diseases of the Vermiform Appendix, London, 1895.

⁸ Kelly, A. O. J.: Deaver's Appendicitis, 1905.

⁹ Kelly and Hurdon: The Vermiform Appendix and its Diseases.

¹⁰ Ferguson, A. H.: American Journal Med. Sciences, vol. cxvi, p. 61, 1891.

¹¹ Ochsner, Albert: Journal American Med. Assn., July, 1899.

¹² Morris, Robt. T.: Lectures on Appendicitis, 1895.

¹³ Heineck, A. P.: Mobile Med. and Surg. Journal, 1907, x, p. 312.

¹⁴ Osler, Wm.: Principles and Practice of Medicine, 1898, p. 520.

¹⁵ Ewing, James, Schultze, Otto, Wood, F. C., personal communications.

¹⁶ Barnes, F. S.: Foreign Bodies as an Etiologic Factor in Appendicitis. Kentucky State Journal of Medicine, February, 1908.

case which stimulated interest in this subject is herewith reported.

Mrs. X., aged sixty-six, was referred to the German Hospital on August 28, 1911. Temperature 102.8°, pulse 128, respiration 28, with the following history: The chief complaint was diffuse abdominal pain. Present attack commenced three days prior to admission, with acute pain in the umbilical region which gradually increased in severity and a few hours after the onset was followed by vomiting of greenish fluid. The following day pain was felt in the right iliac fossa, and gradually spread until the entire abdomen was sore to the touch. Patient again vomited. Bowels moved following catharsis at the onset. Last movement on the morning before the day of admission. Her past history revealed the fact that three years before she had an attack of abdominal pain with vomiting and without jaundice, which was diagnosed as gall-stone colic. Following the subsidence of this attack she was well until the present. My examination showed a universally tender and rigid abdomen, somewhat distended. The face was drawn and expression anxious, a typical picture of diffuse septic peritonitis. The preparatory enema was expelled clear, without flatus or fecal matter. A right rectus incision was made. Pus under tension spurted upon incising the peritoneum. The appendix was isolated and excised. A diffuse peritonitis was present. Pus was mopped up and sponged away. Large rubber tube drains were inserted into the pelvis and down to the stump of the appendix. Upon examination of the appendix it was found to be gangrenous at the middle, perforated, and contained a large enterolith. The appendix was split, enterolith crushed, and a pin discovered entirely encrusted by fecal matter (Fig. 1). The head of the pin was directed downward. It is interesting to note that it was not the pin which had perforated the organ. The fecal concretion was very hard, distinctly laminated. From the fact that it had completely surrounded the pin it is probable the foreign body had been present a long time. It is probable that the attack of abdominal pain of three years ago was due to appendicitis. I was unable to obtain a history of the woman having swallowed the pin. After-treatment consisted in the continuance of the elevated head and trunk position. To this was added the Murphy drip. An effort was made to encourage peristaltic rest

by withholding all fluid by mouth. Repeated gastric lavage was necessary to overcome vomiting. Patient lived for 36 hours, and died from sepsis, complicated by intestinal paralysis, for the relief of which an enterostomy was performed.

J. F. Mitchell has collected 33 cases of pins in the appendix, Kelly and Hurdon have added to this list 13 cases. The writer in searching the literature has been able to find four cases which were overlooked by these observers, namely those of Amyand, Markoe, and Woolsey, and an additional case reported by Roswell Park. Patterson,¹⁷ writing upon the subject in 1906, contributed two additional cases (personal communications from J. C. Hearst and C. H. Frazier). Eleven other cases, including my own, have been reported during the last five years.

It is of historic interest to note that the first authentic case was reported by Claudius Amyand, Esq., F.R.S. This is also the first recorded case of appendectomy performed upon the human subject during life. He operated upon a boy of eleven years in 1735, for the cure of a discharging sinus in the right thigh, which evidently communicated with an irreducible scrotal hernia. Hernia had existed from infancy and for one month there had discharged from this fistula "a great quantity of unkind matter." As it was evident that the cure of the sinus depended upon that of the hernia, "which latter could be obtained by no other operation than that for Bubonocoele," this was agreed to and the operation accordingly performed on the sixth of December. "This operation proved the most complicated and perplexing Mr. Amyand ever met with, many unsuspected oddities and events occurring to make it as intricate as it proved laborious and difficult." The hernia was found to be chiefly omental, "the size of a small pipkin." In its interior lay the appendix cæci which had been perforated by the point of a pin. The head, covered with much encrusted stone, remained within the appendix, acting as a ball-valve and allowing at the most un-

¹⁷ Patterson, F. D.: American Journal Med. Sciences, 1906, p. 859.

expected and inopportune moments a copious discharge of fecal matter over the field of operation.

Twenty-three cases have occurred in children under eleven years of age. We are justified in charging about one-third of "pin cases" to the habit of infancy and childhood of placing everything in the mouth. We would suppose that certain occupations in adults, that of seamstress, tailor, nursemaid, etc., would predispose to this condition. In point of fact such predisposing occupations were mentioned in three instances in this series. A history of the patient having swallowed the pin has appeared in five records. Twenty-four cases occurred in females and 28 in males.

The pin may be found free from deposit, rusty, or corroded and brittle. It may form the nucleus of a fecal concretion and be either partially or entirely surrounded. In cases in which the pin has not been entirely surrounded, it is the head which is most frequently covered with soft or hard fecal matter (Figs. 2 and 3). In this series of cases 22 were encrusted, 7 completely, 15 partially. The appendix was perforated in 48 cases. One would naturally suppose that a pin would lead to rapid perforation. This is not always true. In the majority of cases there is no reason to ascribe the perforation directly to the presence of the pin in the appendix. In a few cases in which the head has been surrounded by a concretion and remained in the appendix, the point and shaft have perforated the appendix and the head has formed a ball-valve (Fig. 4). The head caused ulceration in four cases (Fig. 5). The point was the direct cause of the perforation, and had transfixed the organ in 21 cases (Fig. 6). The pin usually enters the appendix head-first; is generally found straight, but occasionally has been bent upon itself (McPhedron and Caven). In most instances it has been found to lie parallel to the long axis of the appendix. In a number of instances it has been found to lie transversely across the lumen (four cases). The head may ulcerate through one wall and the point perforate the opposite wall. McBurney found two pins in this way lying parallel

FIG. 1.



Gangrenous appendix, perforated. Diffuse septic peritonitis. Pin had not caused perforation, was completely surrounded by enterolith, and not discovered until crushed. Abdominal symptoms, 3 years; acute attack, 3 days. (Case of R. H. Fowler.)

FIG. 2.



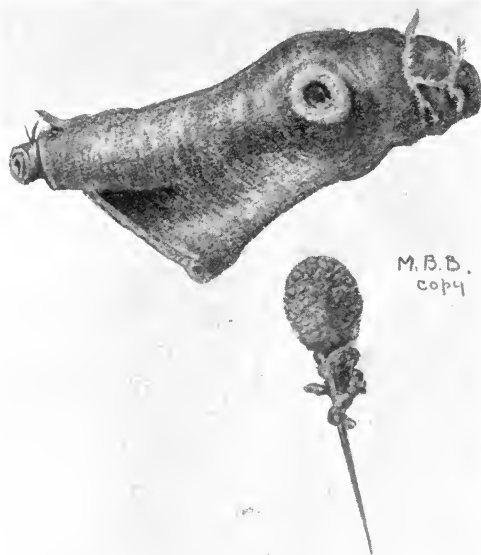
Fecal concretion surrounding head and part of shaft. Appendicular abscess sinus. Symptoms for one month. (Case of F. H. Markoe.)

FIG. 3.



Appendicular abscess; persistent sinus. Pin when removed from appendix was completely encrusted. (Case of J. M. Spellissy.)

FIG 4.



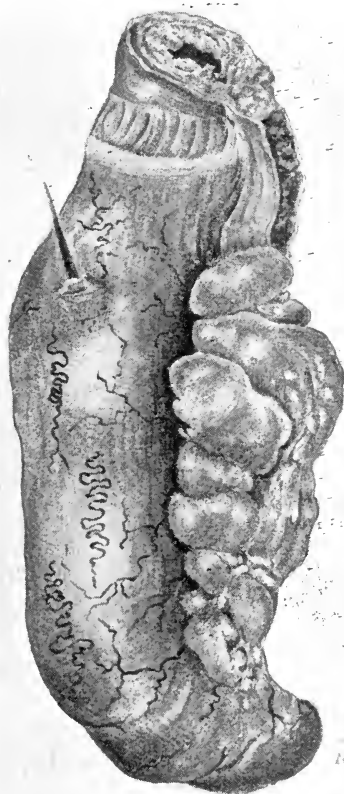
Appendix excised. Head of pin surrounded by an enterolith. (Case II, J. F. Mitchell.)

FIG. 5.



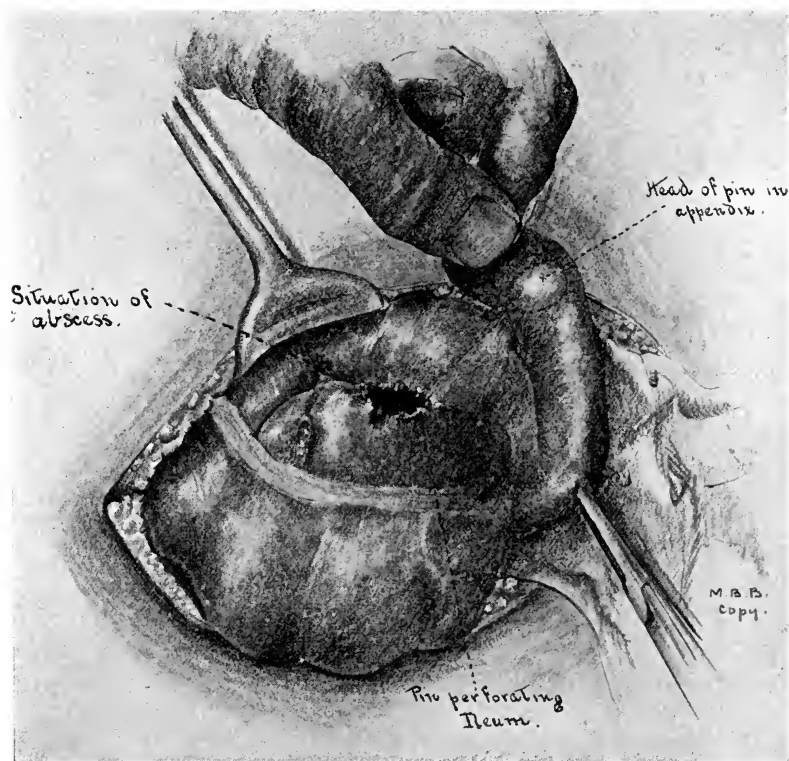
Pin in vermiform appendix, which perforated it by ulceration and caused a fatal peritonitis.
(Specimen in Guy's Hospital Museum.)

FIG. 6.



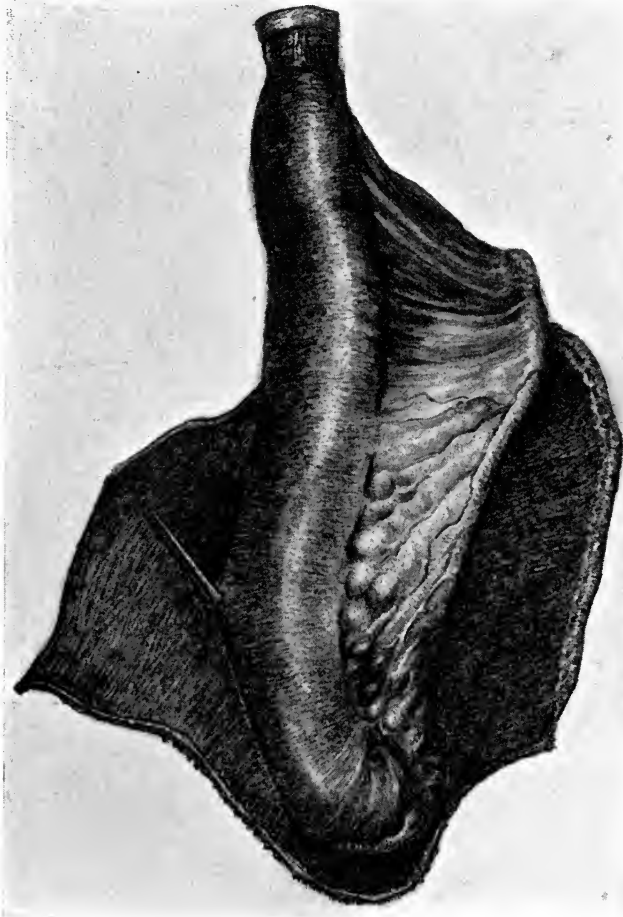
A black pin had perforated the appendix by the point. Appendix rolled up in omentum no pus. Acute attack, 10 days. (Case of John B. Deaver.)

FIG. 7.



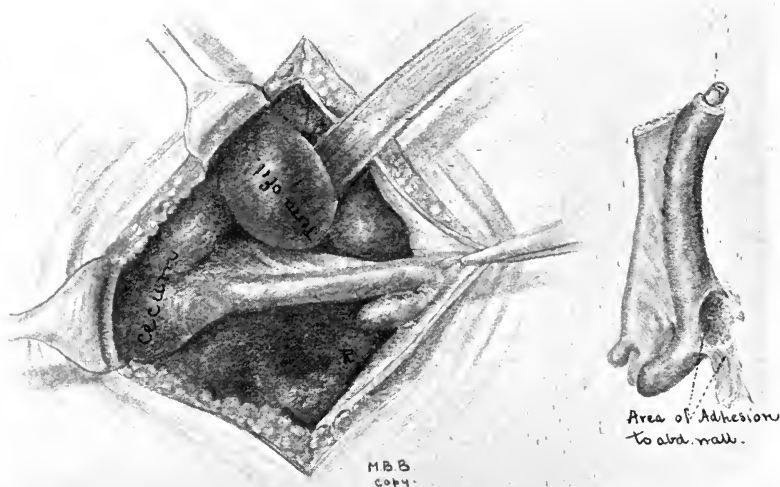
Recurrent appendicitis. Anastomosis of tip of appendix with ileum, through which pin had passed, producing perforation in opposite wall of ileum. Point surrounded by a small abscess, between cæcum and ileum. (Case II of J. F. Mitchell.)

FIG. 9.



Appendix contained in hernial sac transixed by pin. Right inguinal.
(Case of J. A. C. MacEwen.)

FIG. 10.



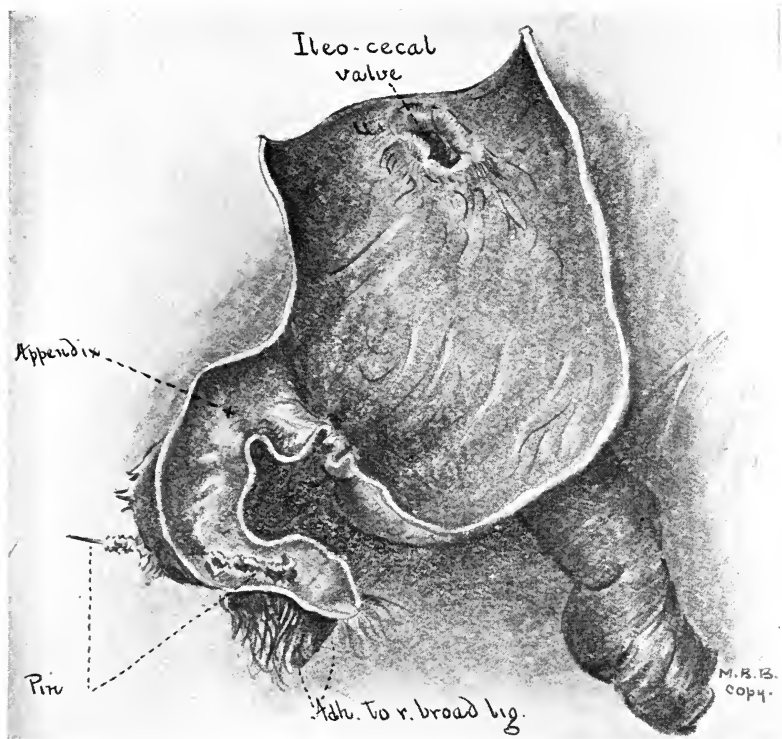
Appendix abscess opened and drained when seven years of age. Persistent sinus. Pin found in the discharge. Appendix adherent to anterior abdominal wall. (Case I of J. F. Mitchell.)

FIG. 11.



Limitation of inflamed area to portion containing pin. Appendix perforated, but not by pin. Diffuse peritonitis. Acute symptoms for a few hours. (Case of Arthur Edmunds.)

FIG. 12.

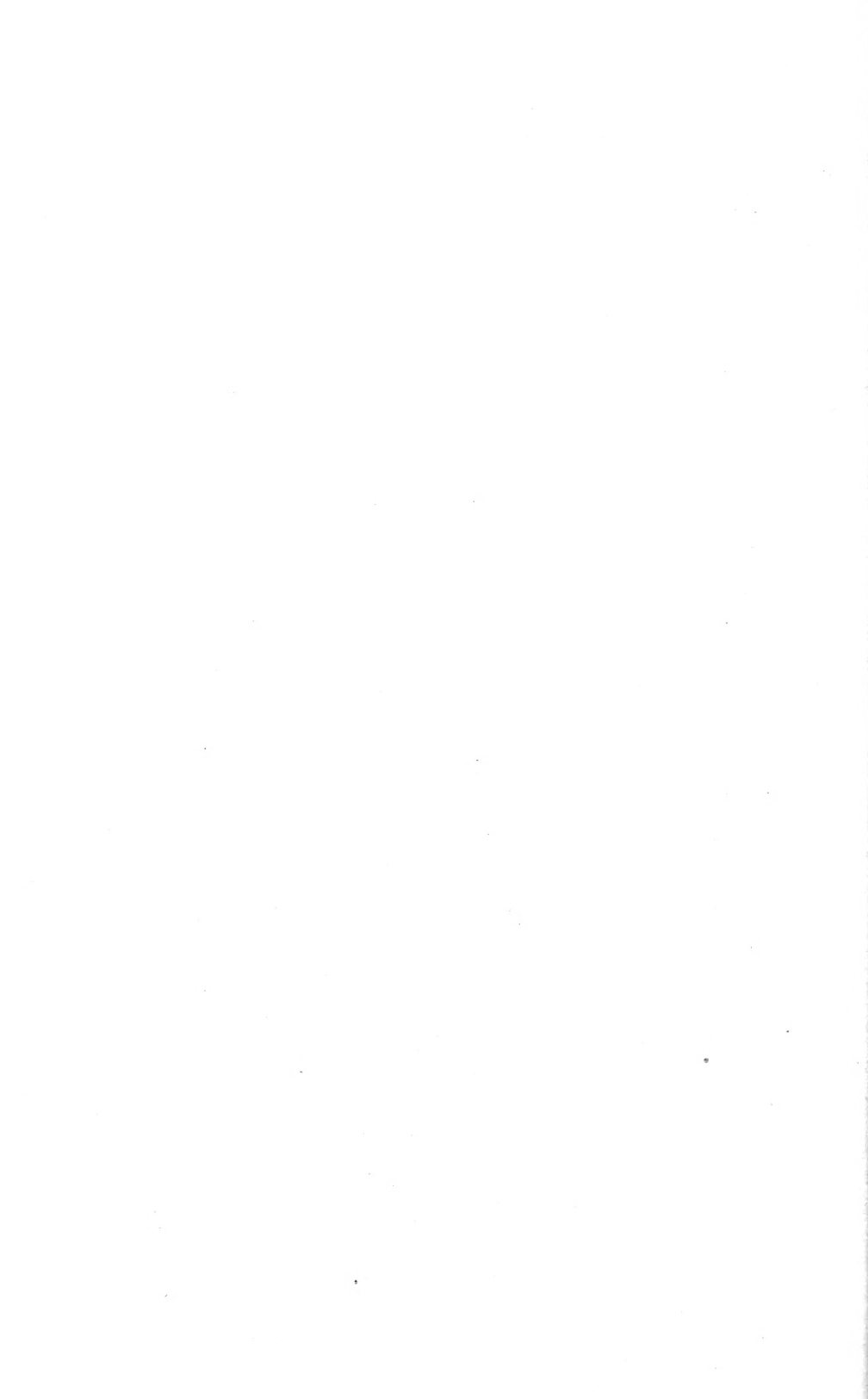


Abscess of the liver. Complained for a year or two of stitch in the side. Diagnosis, pleurisy. Operated upon for abscess of liver. At autopsy the appendix was found adherent to right broad ligament; recent peritonitis; at this point pin had perforated appendix; head remained inside; shaft and point surrounded by adhesions; pin irregularly encrusted. (Case of H. D. Rolleston.)

FIG. 13.



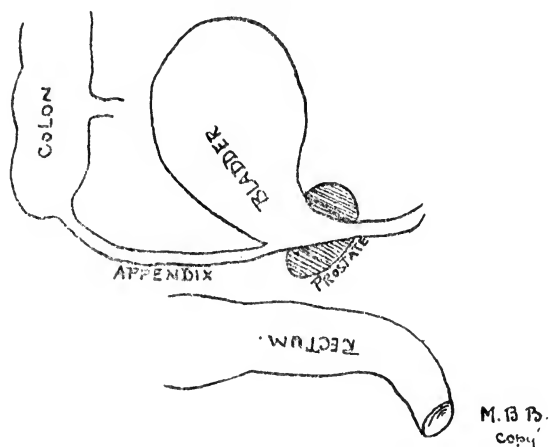
Pin, head down, encrusted. Point lay in a small pocket, which projected from the side. Appendix red, thickened, oedematous. Diffuse peritonitis. Acute attack, 5 days. (Case of F. B. Lund.)



to each other. Hirst also found two pins in an appendix which he removed. In three cases the point of the pin had engaged and become embedded in the wall of the appendix without causing perforation (Joffroy, McPhedron and Caven, and Morriata).

The lesion caused by this foreign body is variable. The appendix has been found practically normal from the outside without perforation and with but slight thickening of the walls of the organ. In other cases perforation has been found to be the result of transfixation or of ulceration by

FIG. 8.



Tip of appendix solidly incorporated in the bladder. Patient when seven years of age had dysuria, at which time pin, which he believed he had swallowed, was removed from urethra. (Case of W. W. Keen.)

the pin. In the majority of cases perforation occurred independently of the pin. Perforation by the pin directly has taken place usually near the base or middle. In one instance the point and shaft had perforated the tip of the appendix, and passing through the ileum had produced a small abscess between the ileum and the cæcum (Mitchell, Fig. 7). In a very interesting case reported by Keen, a pin had been removed from the urethra. The appendix was found at operation adherent to the bladder with which it had established a pathological anastomosis (Fig. 8). A pin encrusted by a

calculus has been found in the urinary bladder, to which organ the appendix had become adherent, having formed a communication and through which the pin had become discharged. The pathological report does not state whether the calculus was formed of desiccated fecal matter or represented a true bladder stone. It was probably a combination of urinary salts and fecal material, inasmuch as the contents of the colon was discharged into the bladder. This patient also discharged worms from the urethra in addition to fæces (Kingdon). In four cases pins have been found in appendices contained in hernial sacs (Fig. 9). In one of these, a strangulated hernia, the pin had perforated and protruded into the dartos of the scrotum (Roberts). Pins have been discovered in the remnants of the appendix in eight cases, causing a persistent sinus. A pin has been observed in the discharge from an appendicular abscess (Mitchell, Fig. 10). In another instance a pin was detected by the probe in a tract, which operation subsequently revealed led to remnants of an appendix (Parrot). Inflammation has been found limited to the portion of the appendix which contained the pin, the proximal portion being practically normal (Edmunds, Fig. 11). In eleven cases an abscess of the liver has existed. Abscess of the liver has developed most frequently in the chronic or subacute cases and in those cases which had not been recognized early. Peritonitis or abscess has not followed all cases in which the pin has perforated the appendix. Adhesions have formed about the point and shaft. Peritonitis was present in 13 cases, appendicular abscess in 30 cases. In eight cases the pin was found in the abscess cavity.

In but few instances have foreign bodies been suspected before operation. The duration of abdominal symptoms has been variable. In two cases it was stated no symptoms had existed referable to the appendix. They have been found to exist for from a few hours to 15 years. Symptoms have been chronic in the majority of cases, most showing an acute exacerbation (32 cases). Acute symptoms of less than 10 days' duration without previous attacks have existed in 13

cases. Mild symptoms with recurrent attacks or long-continued pain may be present or but a slight uneasiness in the right iliac region. Signs of rapid perforation at the onset without a history of previous disturbances are rare (Edmunds and Galzebrook). In a few instances pins have apparently remained dormant in the appendix for years, until lighted up by a blow upon the abdomen (Bell, Morriata).

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THE RELATION OF THE ILEOCÆCAL FOLDS TO APPENDECTOMY.

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RECENTLY, after reading an article on pericolicitis, I called the attention of the writer to the fact that he had failed in his text and illustrations to make any mention of the normal ileocæcal folds, and from his reply I was led to believe that their existence had escaped his attention.

I have since questioned many men doing surgery, and find, at least locally, that no cognizance has been taken of these folds. Whether or not their presence is as important as I would be led to infer from the case which I append, I am not prepared to say, this being but a single observation of this particular condition. Further observation will prove or disprove.

Anatomy.—About the head of the cæcum will be found normally two peritoneal folds and a fossa, which are constantly present and known respectively as the superior and inferior ileocæcal bands and fossa. In the majority of specimens will be found also a third fold known as the retrocolic fold, which, however, is not constant.

The superior ileocolic fold is formed by a reflection of the peritoneum which extends from the upper surface of the terminal end of the ileum to the anterior aspect of the cæcum, and carries in the free margin the anterior-ileocæcal branch of the colic artery. Below this will be found a pouch (superior ileocæcal) which opens downward and to the left.

If the cæcum be turned upward so as to expose the posterior surface as it lies *in situ*, and the appendix be pulled down so as to put its mesentery on the stretch, a fold of peritoneum will be found to run from that surface of the ileum most removed from its mesentery across the posterior

surface of the cæcum, becoming finally lost in the meso-appendix. This fold carries a recurrent branch from the appendicular artery, and with the ileum and cæcum forms a pouch (inferior ileocæcal) large enough in most instances to admit two fingers.

Some months ago, I was consulted by a man, aged thirty-one years, who gave the following history: One year ago suffered from pain and tenderness in the right iliac fossa which was diagnosed as appendicitis. The appendix was removed with relief from symptoms for about a month, when symptoms similar to those diagnosed as appendical recurred.

The patient also complained of fulness in abdomen and general abdominal distress. Then, as the patient described it, there was a sensation of something giving way, accompanied by a gurgling sound in the cæcal region, after which the abdominal distress is relieved.

Physical Examination.—Heart and lungs normal, no mass to be felt in abdomen, no point of tenderness. Under a provisional diagnosis of pericolicitis, the abdomen was opened. No adhesions of any consequence were found, but as the cæcum lay *in situ* I found that the mesentery to the ileum was rather long, the superior ileocæcal fold had been destroyed, and the ileum entered the cæcum at an extremely obtuse angle. Nothing else was found to account for his symptoms, so I reconstructed a superior ileocæcal fold which I found brought the ileum in normal relation to the cæcum, and by light plication of the mesentery I supported the terminal portion of the ileum.

An uninterrupted recovery followed, and the patient has been free from symptoms for three months.

The conclusions I drew from this case were that the destruction of the superior ileocæcal fold allowed the ileum to hinge on its entrance into the cæcum, preventing the fæces entering the cæcum until finally overcome by violent peristalsis. I have always, when possible, preserved these ileocæcal folds, believing that they were instrumental in preserving the patency of the ileocæcal opening. Although, as I said

before, I have no absolute assurance of their importance, this case seems to substantiate it.

The fact remains that after the operation for appendicitis many patients are not relieved of their symptoms and are submitted and resubmitted to operation "for adhesions," until finally they bear the ills they have rather than fly to others they know too well.

Much is being done through our recent investigation on pericolicitis. Perhaps these ileocæcal folds may prove also important.

FRACTURES OF THE GREATER TUBEROSITY OF THE HUMERUS.

WITH AN OPERATIVE PROCEDURE FOR FIXATION.

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BEFORE the introduction of the X-ray, fracture of the greater tuberosity of the humerus was looked upon as an extremely rare occurrence. Gurlt in his exhaustive treatise on fractures was able to collect from the literature and museum preparations only 46 cases, of which number 42 were associated with other lesions, especially with dislocation of the shoulder. Only four cases of isolated fracture had been reported, and as Gurlt had seen none of them he questioned very much the occurrence of such a lesion. Such was the prevalent opinion until the introduction of the X-ray, since which time the lesion has been recognized with increasing frequency, until now it is known that these cases are of rather common occurrence. Dr. Hollis Potter, in his X-ray experience at the Cook County and Presbyterian Hospitals of Chicago, has met with 20 cases. Keen reports that within the period from 1903 to 1907, 39 cases were seen by a half dozen Röntgenologists in Philadelphia, and numerous articles reporting series of cases from the European clinics have appeared within the past few years.

A still more striking feature is the frequency with which isolated fracture has been met. Of the 39 cases collected by Keen, 21 were isolated fractures and 18 were associated with other lesions about the shoulder. Jacob first pointed out their frequent occurrence, when in 1901 he reported seven cases which had come under his observation among the soldiers of the French army. Nieszytka in 1906 reported eight cases from Hoeftmann's Königsberg clinic, which were observed

within a period of 15 months, and very recently Melchior reports 30 cases treated in Küttner's clinic within the past eight years.

From these statistics we see that not only has there been an increase in the frequency of recognition of fractures of the greater tuberosity in general, but that isolated fracture is of equal importance to that of fractures associated with other lesions. The unrecognized cases, such as the two here reported, have gone about for months and sometimes for years under various mistaken diagnoses such as "contusion" of the shoulder, "paralyzed deltoid," and stiff joint following dislocation of the shoulder. An X-ray examination in these cases of long standing will nearly always make the diagnosis, as the fragment is frequently displaced, but when not the evidences of fracture are slow in disappearing.

Of the isolated fractures, direct violence resulting especially from a fall upon the shoulder is nearly always the cause. A few cases have occurred from indirect violence, such as violent elevation of the arm, particularly when combined with traction as from the jerk of a rearing horse. Fractures from indirect violence due to a fall upon the elbow, or from muscular action alone, as in Gibbons's case, have also been observed. In any event the tuberosity is brought in contact with the acromion, which, combined with the muscular action, is sufficient to break it off. Fracture of the greater tuberosity occurring in connection with dislocation of the shoulder is due mainly to the resistance offered to the dislocation by the supraspinatus, infraspinatus, and teres minor muscles and the coracohumeral ligament, all of which are inserted to it. However, when either a dislocation or a fracture of the upper end of the humerus is produced by direct violence to the shoulder region, this force may at the same time break off the tuberculum majus.

Pathologically the fracture may be either partial or complete, the former being much the commoner, particularly in the case of isolated fractures. In partial fracture the size of the fragment is extremely variable, ranging anywhere from

that of a small scale to the greater portion of the tuberosity. Most of the smaller pieces are chipped off of the top, but many come from the anterior margin, in which event the line of fracture is largely longitudinal. Displacement is usually slight in case of the smaller fragments, but in the complete fractures it may be very marked. The action of the attached supraspinatus, infraspinatus, and teres minor muscles pulls the fragment backward and upward, so that it becomes wedged in between the posterolateral surface of the head and the acromion. The fracture surface of the fragment comes in contact with the cartilage covered articular surface of the head, thus rendering union either difficult or impossible. Union with the shaft occurs with very little callus formation when there is slight displacement. Attachment in an extremely abnormal position has been noted in some cases, such as those accompanying old unreduced dislocation of the shoulder. Based upon X-ray findings, callus formation on the part of the fragment is very slight, but that it occurs will be seen in the pathological report of this case. Jössel described the changes in the supraspinatus, infraspinatus, and teres minor muscles which occur after some time as a result of inactivity. There is marked retraction with atrophy and fatty degeneration of the muscle fibres. This retraction interferes markedly with replacement of the fragment during operation on neglected cases. The unopposed subscapularis in these cases also retracts and fixes the arm in internal rotation.

The symptomatology varies greatly with the size and amount of displacement of the fragment and with the presence or absence of associated lesions. Without an X-ray examination most of the cases accompanying dislocation of the shoulder are overlooked, and it is only after the dressing is removed that persistent disturbance arouses suspicions of a complicating lesion. The small group of cases, in which the greater portion or the whole of the tuberosity is broken off and displacement is marked, present the classical group of symptoms described for the condition by Gurlt, which make possible the diagnosis from physical examination alone: fol-

Following an injury or the reduction of a dislocation there is a large amount of pain and loss of function in the shoulder-joint; moderate swelling occurs, but ecchymosis and crepitus are generally absent. After the swelling has disappeared and particularly when the case is seen after some time the picture is as follows: the arm is held by the side and movements are very much limited. If the case is of some standing there is marked atrophy of the supraspinatus, infraspinatus, and teres minor muscles, and moderate atrophy of the deltoid. The head of the humerus appears abnormally broad anteroposteriorly, which results from the backward displacement of the fragment. External rotation is lost, but internal rotation is possible to an abnormal degree, due to the action of the unopposed subscapularis muscle. Palpation shows the prominence posterior to the head and just below the acromion to be slightly movable in the earlier cases, at times separated from the head by a groove, and usually tender upon manipulation. Crepitation is generally absent. Abduction is very much restricted by the wedge-like action of the fragment between the head and acromion. More or less permanent disability results from this type of lesion. In the cases of partial fracture and particularly the isolated ones the picture is a different one, as some of the symptoms just enumerated are lacking. Following the injury there is severe pain and loss of function out of all proportion to the apparent extent of the injury. Ecchymosis very rarely occurs. Palpation shows tenderness in the region of the tuberosity, but in the majority of cases neither an abnormal bony prominence nor crepitation can be detected. Motion is limited in all directions, and external rotation is either diminished or absent. Without an X-ray examination these cases are nearly always looked upon as contusions and a favorable prognosis given. However, the pain and stiffness do not clear up at the expected time, tenderness beneath the acromion persists, and a certain amount of atrophy of the muscles may develop. These symptoms may last for months or even for years, and in a few cases partial disability of the shoulder-joint results.

Perthes claims that most cases of habitual dislocation of

the shoulder are the result of either a rupture of the insertion of the supraspinatus and infraspinatus muscles or less rarely of old fracture of the tuberculum majus.

In making the X-ray pictures the arm should be placed in adduction and external rotation, as otherwise the tuberculum majus overlaps the head and fractures are easily overlooked.

Treatment of the condition varies with the extent of the fracture and the amount of displacement present. Partial or even complete fracture in which there is little displacement of the fragment is best treated by immobilization for from one to three weeks, followed by massage, passive motion, and exercises. Too lengthy immobilization favors the development of a stiff joint. Complete fractures with displacement of the tuberosity should be treated by operation, although the number of operated cases reported is small. Conservative treatment in the latter group of cases results in more or less permanent disturbance of function of the shoulder-joint. Operation has been advised against by Deutschlander on the grounds that the injury to the soft parts thus produced results in more disturbance of function than the fracture itself. Bardenheuer and Graessner recommend upward and backward extension with the limb in external rotation, but the position is an uncomfortable one and difficult to maintain.

The following methods of approach have been used for exposing the seat of injury, replacing the fragment, and wiring or nailing it in position:

1. Anterior incision, beginning over the coracoid process and extending downward along the anterior border of the deltoid as in resection of the shoulder-joint. In order to reach the tuberosity which is displaced backward and upward and to procure sufficient room for fixing it in place, extensive division of the anterior portion of the deltoid is necessary, and considerable disturbance in function may result.

2. Lateral incision, as employed by Keen, extending downward from the acromion, and splitting the deltoid fibres low enough to give sufficient exposure of the seat of fracture

for replacing the fragment and fixing it. As the nerve supply enters the muscle from the rear, the anterior half will be paralyzed if the fibres are split much below the middle, so that without transverse section of part of the muscle near its origin access to the field of operation is very much limited. Dr. Keen communicates that the patient upon whom he operated in 1907 has a satisfactory result except for inability to elevate the arm beyond 90 degrees, which has probably resulted from deltoid injury.

3. Posterior incision, employed in this case. In order to avoid all injury either to the deltoid muscle or to its nerve supply and to obtain a complete exposure both of the seat of the fracture and of the muscles attached to the broken off tuberosity, an angular incision is made from the tip of the acromion backward over the entire length of the spine of the scapula and then downward along the posterior border of the deltoid, after which an osteoplastic resection of the origin of the deltoid is made and the musculocutaneous flap turned forward. This route was first used by Kocher for resection of the shoulder-joint. Perthes employed it in operating for habitual dislocation of the shoulder and Drüner for removal of a sarcoma of the posterior superior humeral region. No record could be found of its employment for fracture of the tuberculum majus. The case reports are as follows:

CASE I.—John K., aged twenty-four, entered the surgical dispensary of Rush Medical College, June 22, 1911, with the history that 14 weeks previously he fell from a scaffold a distance of 15 feet, striking upon the right shoulder. He had severe pain and immediate loss of function of the joint. A physician diagnosed contusion of the shoulder and ordered hot applications and massage. These were kept up most of the time, and although the pain was considerably less, the function in the joint remained about the same. Upon examination the arm was held immobile by the side. There was marked atrophy about the shoulder in the region of the supraspinatus, infraspinatus, teres minor, and deltoid muscles. Internal rotation of the arm could be accom-

plished slightly beyond normal but there was complete loss of external rotation and of abduction. Viewed from the side the acromion was prominent and the head of the humerus was broadened considerably in its anteroposterior diameter, this being due to a bony prominence on its posterior and superior surface. Palpation of this prominence showed that it was tender and slightly movable. It was wedged in between the acromion and the head of the bone and locked the joint so that abduction could be accomplished only to a very slight degree. No crepitation could be elicited. X-ray examination (Fig. 1) showed the tuberculum majus completely detached and in two pieces, both of which were displaced backward and upward and rotated so that the anterior fragment lay just beneath and in contact with the acromion.

Operation (June 24, 1911).—An angular incision was made beginning anteriorly over the acromion, extending backward along the entire length of the spine of the scapula and then downward and forward along the posterior border of the deltoid to within $1\frac{1}{2}$ inches of its insertion (Fig. 3). The spine of the scapula was freed above, and the few fibres of the trapezius inserted to its inner extremity and overlapping the deltoid were sectioned. The deltoid muscle was then lifted up and undermined and the infraspinatus pushed away from the inferior surface of the spine. Beginning posteriorly a strip of bone about $\frac{2}{3}$ cm. thick and containing the attachment of the deltoid was chiselled off the entire length of the spine and acromion. This permitted the musculocutaneous flap to be thrown forward and outward (Fig. 4), giving a full exposure of the head of the humerus, the broken off tuberculum majus, and the supraspinatus, infraspinatus, and teres minor muscles inserted to it. There was a moderate amount of fibrous and little bony callus about the fragments and covering over the raw surface of the humerus. The fragments were slightly movable, but because of the contracted and atrophied conditions of the muscles attached it was difficult to bring them forward and downward into place. This was made possible by a rather extensive loosening up of the tendons, a procedure rendered easy through the complete exposure obtained by this route. The fragments were rather spongy and easily penetrable, for which reason wire sutures (instead of nails as employed by others) were used for fastening them in place. A piece of frag-

FIG. 1.



Fracture of great tuberosity of humerus (Case I).

FIG. 2.



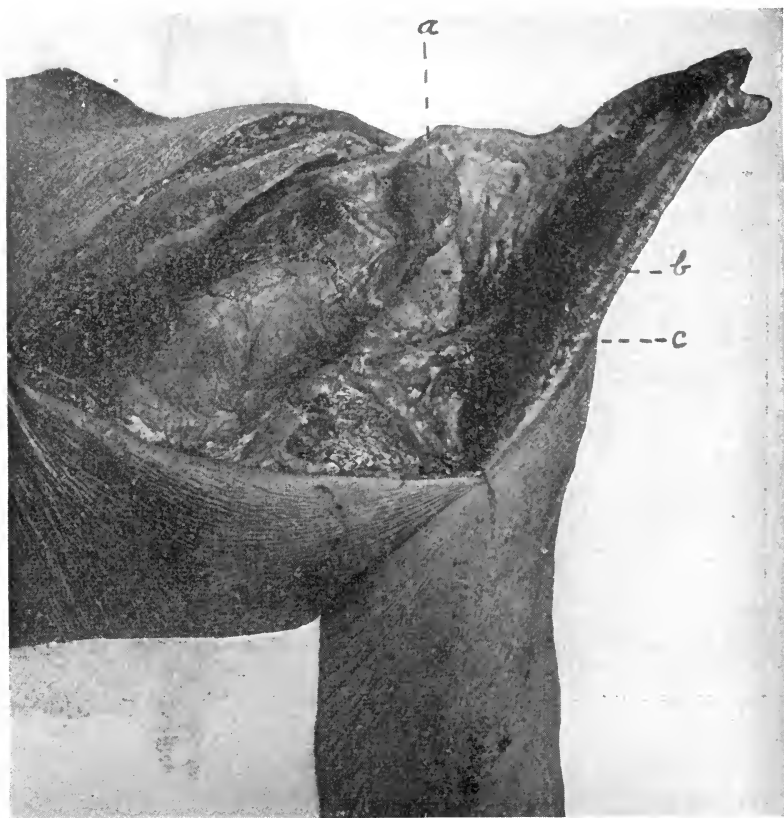
Fracture of great tuberosity of humerus (Case II).

FIG. 3.



Line of incision with flap retracted, showing spine of scapula and posterior border of deltoid.

FIG. 4.



Flap thrown forward and outward, exposing broken-off tuberosity (*a*) and its attached muscles; fractured surface of humerus (*b*), and circumflex nerve and vessels to the deltoid (*c*).

FIG. 5.



Osteoplastic flap sutured in place.

ment was excised for microscopical examination. The musculo-cutaneous flap was then reflected, and the strip of resected spine containing the deltoid attachment was tied into place by three kangaroo tendon sutures encircling it, and traversing holes bored through the remaining portion of spine (Fig. 5). The ends of the divided small trapezius tendon were next united and the skin incision closed without drainage. The wound healed by primary union. The arm was bandaged to the chest for two weeks, after which it was left free and after three weeks active and passive motion was begun. There had been gradual improvement, until now, six months after operation, almost complete function of the shoulder-joint has returned and the patient has been working as a laborer for some time. There is still slight limitation of abduction, but otherwise the movements are free.

Microscopical examination of the excised fragment: This shows that its entire surface is covered by callus, which is scanty in the region covered by periosteum to which there is tendon inserted, but more abundant about the edges and over the fracture surface, where it consists of newly formed, somewhat spongy bone filling the narrow spaces and fibrocartilaginous layers about the periphery. The callus in the region covered by periosteum is composed of a very thin and interrupted inner layer of spongy bone and an outer layer of fibroblasts, which also extend for some distance out between the fibres of the inserted tendon. Numerous canals of the thin compact cortex have been dilated, and newly formed bone and osteoid tissue have grown in as a substitute, thus giving it a somewhat spongy character.

The following recently observed case serves as an illustration of fracture of the tuberculum majus accompanying dislocation of the shoulder:

CASE II.—James N., aged sixty-eight, entered the surgical dispensary of Rush Medical College, April 15, 1911, with the history that January 4, 1911, he fell upon the right arm and dislocated the shoulder-joint. A physician reduced the dislocation and bandaged the arm to the chest, in which position it was left for about one month. Since the removal of the bandage the shoulder has been stiff and painful, so that he has been en-

tirely unable to use the arm. During the past six weeks he has had electrical treatments under the diagnosis of paralysis of the deltoid but without any appreciable improvement. Examination showed some wasting of the posterior shoulder muscles and of the deltoid. Motion was greatly restricted, but both abduction and external rotation were possible to a limited degree. Palpation laterally revealed a small bony prominence extending upward from, and seemingly attached to, the head of the humerus. X-ray (Fig. 2) showed that the broken off tuberculum majus had been displaced upward for about a half inch and had become attached in this position, as there was evidence of callus about the point of approximation. The patient was treated with massage and exercises, but when last seen, six months after the injury, there was little improvement.

The advantages of the operative procedure employed in this case are: The complete exposure which it gives, not only of the seat of fracture but also of the muscles attached to the fragment, and the freedom from injury to both the deltoid muscle and its nerve supply. In case of fracture of long standing, as in this one, where the attached muscles are contracted and have to be loosened up before the fragment can be restored to its normal position, there is little doubt that this should be the operation of choice.

The disadvantages are that although easily performed it is a more extensive operative procedure, and in the event of an infection would give a more formidable condition with which to deal.

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SEPARATION OF THE EPIPHYSIS OF THE FIRST METACARPAL BONE.

WITH REPORT OF A CASE.

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THE first metacarpal bone develops from two centres, one for the shaft and one for the epiphysis, which is situated at the proximal end of the bone instead of the distal end as in the four other metacarpal bones. Rarely an epiphysis forms at the distal end.

"The epiphyseal centre appears during the third year and is united to the shaft at twenty years" (Poland¹).

This bone is in effect anatomically a phalanx. Authentic cases of separation of the epiphysis are extremely rare. Piersol² in 1907 says but one case of disjunction has been recognized during life. It resembled a dislocation at the carpometacarpal joint, but the seat of abnormal movement was below the level of the lower edge of the trapezium. Cotton³ says that in injuries of the metacarpals the epiphyses play little part, rarely they may be displaced. No specific instance of separation of this epiphysis is made. Poland says that direct as well as indirect violence may be the cause of the separation. He states there are only two simple cases recorded, one at eighteen and one at sixteen years of age, and quotes Mr. R. Clement,⁴ who reports a case of displacement backward.

These two cases are the only ones I have been able to find in medical literature of separation of the epiphysis of this metacarpal. It is doubtless possible that others which I have missed have been reported. The following is then perhaps the second reported case of pure separation of the lower epiphysis of this bone:

FIG. 1.



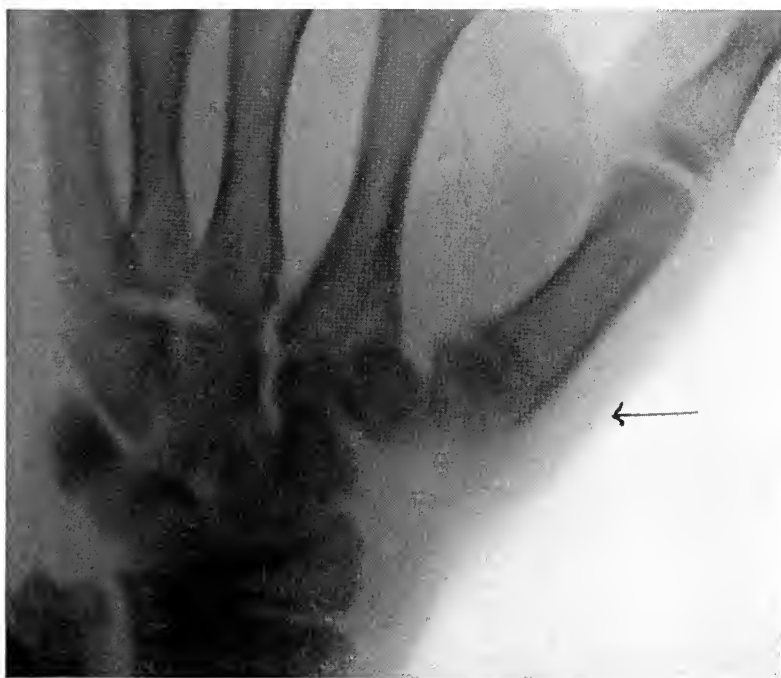
Normal epiphysis of first metacarpal bone. Boy, 14 years old. (December, 1911.)

FIG. 2.



Separation of epiphysis of first metacarpal bone. (December, 1911.)

FIG. 3.

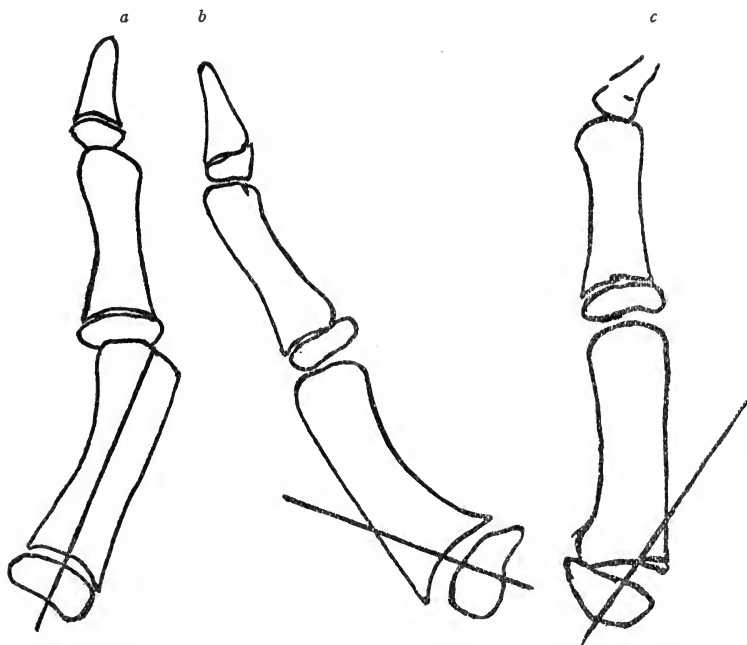


Separation of epiphysis of first metacarpal bone. (December, 1911.)



M. S., a healthy boy of fourteen years, was seen at the Surgical Clinic of the Boston Dispensary December 18, 1911. The day before coming to the clinic he had fallen down while running in the street. He tripped on the curbing, striking his left thumb on the curb with great force. The hand was in front of the body, the fingers and thumb flexed. Immediate great pain and disability of the left thumb was noticed.

FIG. 4.



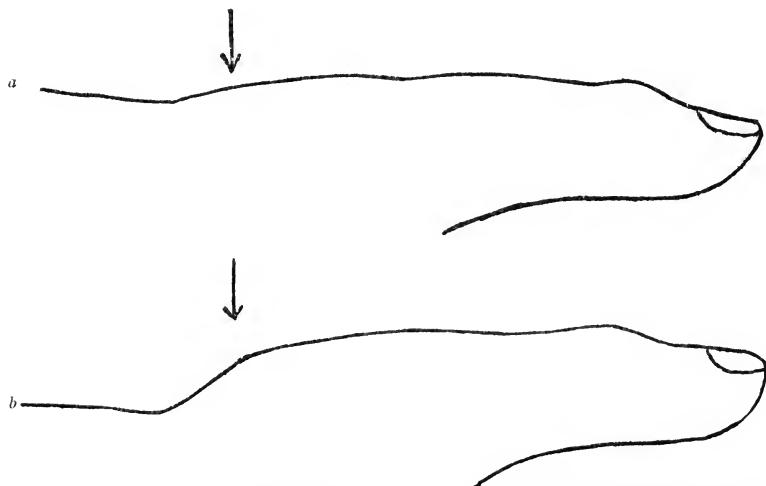
a, X-ray tracing of normal thumb. Note axis of epiphysis to diaphysis. (December, 1911.) *b*, *c*, X-ray tracing of injured thumb. Note axis of epiphysis. (December, 1911.)

Examination showed a well-developed and nourished boy of fourteen years. There was considerable swelling over the dorsum of the thumb in the neighborhood of the carpometacarpal joint. There was no obvious deformity but extreme pain on pressure here, which was also present on pressure over the snuff-box. There was abnormal mobility detected at the base of the metacarpal with a slight doughy crepitus. Flexion and extension of the fingers was perfect; the radius and ulna were not painful to palpation. Hand put temporarily on anterior splint.

December 22, marked pain on pressure over the base of the metacarpal; abnormal mobility of the epiphysis detected; slight grating crepitus; flexion and extension of fingers normal; radius and ulna normal. Thumb splint applied. The X-ray, two views, showed plainly separation of the epiphysis.

December 29 there was slight ecchymosis seen for the first time over the region of the external border of the second metacarpal. Slight rounded prominence at base of first metacarpal; tenderness gone almost entirely; flexion and extension of entire thumb not painful. Lateral pressure over epiphysis still very painful. Last appearance at clinic.

FIG. 5.



a, Tracing of normal thumb, February 8, 1912; *b*, tracing of injured thumb, February 8, 1912. Note sharp jog at epiphysis of metacarpal.

February 8, 1912, the boy was seen outside and the following note was made: He has been using the hand for some weeks. There is no pain or disability; he plays ball without trouble. Examination shows no abnormal mobility. Considerable thickening about carpometacarpal joint with slight prominence on outer free border. Movements of thumb not restricted. Slight pain on pressure over prominence.

Clement's case is as follows:

C. W., age sixteen, came to Guy's Hospital March 6, 1885. He had fallen with his hand bent under him, the weight of the body being received upon the outer side of the left thumb. This was bruised and painful.

He was unable to move it without great pain. There was a projection outward and backward at the base of the metacarpal bone which at first sight appeared to be caused by a dislocation of the carpometacarpal joint. The dresser attempted a reduction and failed. Under chloroform, Mr. Lucas traced the metacarpal bone down toward its base, where it terminated in a projection situated on the outer and posterior aspect of the thenar eminence. It could be easily pressed into place, but showed a tendency to recur to its usual position. There was no true bony crepitus. The seat of abnormal movement was too inferior to be in the joint between the metacarpal bone and the trapezium, and the symptoms present were considered sufficient to distinguish it from dislocation of the metacarpal bone. Reduction was effected by pressure and extension, and a well-padded splint was applied from the wrist to the end of the thumb on its dorsal aspect. A complete recovery without deformity took place in three weeks.

Sturrock⁵ says one case was seen where separation of the head of the first metacarpal as an epiphysis was diagnosed by an eminent surgeon, though the epiphysis for the extremity of this bone is usually at the base. In many instances there is also one for the head (Quain). The accident referred to occurred in a patient of eighteen years, and now, fourteen years after the accident, there is very slight stiffness of the joint, with some thickening but no shortening.

The possibility of separation of the epiphysis of the first metacarpal bone should always be considered in the diagnosis of injuries in the neighborhood of this region in children and young adults. A skiagraph, two views, should always be taken. This injury should not be confused with Bennett's stave fracture of the metacarpal.

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AN OPERATING ROOM MIRROR.

A DEVICE TO FACILITATE THE VIEW OF OPERATIONS IN THE OPERATING THEATRE.

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It is an appreciated fact that in operating in amphitheatres and clinic rooms, many of the exact details in an operation are lost to the observer who is not in an advantageous position. This is due chiefly to two reasons: first, the angle from which the observer views the operation does not give the true relationship of the structures; second, his view is often totally obstructed by either the surgeon or the assistants.

To overcome this difficulty, different devices, chiefly in the form of mirrors, are in use in various clinics in England, Scotland, and on the continent, but so far as is known they have not been tried in this country.

Based on this idea, a mirror was constructed for St. Mary's Hospital (Mayo clinic) and has been used long enough to demonstrate its usefulness and warrant a brief description. Granting that the rather small operating rooms in this clinic are more suitable for successful application of such a device, yet its modification would be practical for use in rooms of larger size.

The mirror is rectangular in shape and measures 62 in. by 32 in. It is suspended from the ceiling by two rods, one at the centre of each end, and any angle is readily obtained, as the attachments of the rods are hinged and can be fixed in position by set screws. The mirror is suspended at a height at least six feet above the operating table, which is placed immediately beneath, with its length parallel to the long axis of the mirror. The angle of the mirror is adjusted so that the observer, looking in the mirror, obtains a view of the operative field as shown in the photograph. This arrangement gives the spectator a true image of the operative field, the only disadvantage being that one must become accustomed to the novelty due to the impression that the operator and assistants are left-handed.

FIG. 1.



Photograph of operation as reflected in mirror above operating table.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held at the New York Academy of Medicine,
April 10, 1912.*

The President, DR. CHARLES L. GIBSON, in the Chair.

CARCINOMA OF THE NECK.

DR. CHARLES H. PECK presented a man, 56 years old, who was admitted to the Roosevelt Hospital on June 30, 1909, with a large, indurated mass occupying the left side of the neck. The swelling had first been noticed about two and a half months before, and was small and movable at that time. It was situated midway between the angle of the jaw and the clavicle, and had infiltrated the sterno-mastoid muscle and the overlying skin.

Operation, July 1, 1909: After turning back a large skin flap, a block dissection was done from below upward, removing with the tumor the entire sterno-mastoid muscle, which was extensively infiltrated, the internal jugular vein, which was involved in the growth, glands, fat and areolar tissue, including the sheath over the scalenus anticus. Three or four glands in the upper carotid region were involved, and a thorough dissection was done up to the base of the skull. Before replacing the flap, a large, oval-shaped involved area in the centre was excised.

The specimen was submitted to the late Dr. Hodenpyl, who reported that it was an infiltrating carcinoma of the alveolar type, with involvement of the lymph nodes. The prognosis was considered absolutely bad, and Dr. Peck said he was greatly surprised when the patient presented himself a few days ago, apparently quite well and free from signs of recurrence, nearly three years after the operation.

EXOPHTHALMIC GOITRE: PARTIAL THYROIDECTOMY.

DR. PECK showed three cases of this kind. The first was that of a woman, 27 years old, who was admitted to the Roosevelt Hospital on March 26, 1912. She had a goitre which had been present for a number of years, and for the past year she had suffered from marked symptoms of hyperthyroidism, namely, exophthalmus, tachycardia, tremor, nervousness, sweating and diarrhoea. She complained of a feeling of swelling and choking during the menstrual periods. Her pulse ranged between 120 and 130 per minute.

After four days' rest in bed, the patient was operated on March 30, under insufflation anæsthesia, with a preliminary injection of morphine and hyoscine. A partial thyroidectomy was done, with excision of the right lobe and isthmus.

The operation and anæsthetic were well borne, but after stopping the latter the patient did not breathe well, remained cyanosed and developed signs of pulmonary œdema. This cleared up rapidly under cupping, and after three or four hours she was bright and cheerful and showed a very moderate operative reaction. Her convalescence was unusually smooth for a patient who had shown such pronounced symptoms of hyperthyroidism.

Dr. Peck said he was inclined to attribute the patient's collapse after the operation to the dose of hyoscine she had received.

The second case was a single woman, 25 years old, who was admitted to the Roosevelt Hospital on November 27, 1911. She had had a goitre of moderate size for about ten years, which had been gradually increasing in size, especially during the past two years, and for the last six months she had had mild symptoms of hyperthyroidism, *i.e.*, nervousness, a tendency to perspire freely, flushing of the face, etc. There was no exophthalmus nor tachycardia and her general health was good.

Operation, November 29, 1911, under insufflation anæsthesia. A partial thyroidectomy was done, the right lobe and the isthmus being removed. The operation was well borne, the pulse never going above 102. The patient made a prompt recovery, and left the hospital, well, on December 10, 1911.

Pathologically, the gland proved to be chiefly colloid in type, showing a tendency to hyperplasia, with infolding and piling up of the epithelium in spots.

Dr. Peck's third case was a female, eighteen years old, who was admitted to the Roosevelt Hospital on June 23, 1909, with a goitre of moderate size. She complained of palpitation and fairly marked symptoms of hyperthyroidism. There was moderate exophthalmus.

Under gas and ether anæsthesia, both superior thyroids were ligated and divided, the operation being done on June 24, 1909. Her convalescence was delayed by an ether pneumonia, and she was discharged on July 9, 1909. She was re-admitted on December 2, 1909, with marked improvement in her symptoms and some diminution in the size of the goitre. Two days later a partial thyroidectomy was done, the right lobe and isthmus being removed. The operation, which was done under gas and ether administered through nasal tubes, was well borne, and the reaction was moderate. She left the hospital, well, eleven days after the operation.

In this case, Dr. Peck said, the preliminary ligation of the superior thyroids had apparently been distinctly beneficial.

LARGE COLLOID GOITRE.

DR. PECK also presented a man, 33 years old, a Syrian, who was admitted to the Roosevelt Hospital on April 19, 1911, complaining of the deformity and inconvenience caused by a large goitre. It had been present since childhood, and had gradually increased in size up to seven or eight years ago, since then remaining stationary. He had never had any symptoms of hyperthyroidism nor obstruction.

A partial thyroidectomy was done on April 21, 1911, the right lobe and isthmus being removed. The operation was done under insufflation anæsthesia, which rendered it comparatively easy, in spite of the large size of the mass. The section removed measured 19 cm. in length and weighed 620 gms. It was colloid in type, but showed areas of hyperplasia.

The patient made a good recovery and left the hospital, well, on May 1, 1911, ten days after the operation. The left lobe of the thyroid had greatly diminished in size since the operation.

DR. CHARLES N. DOWD said that a great many surgeons were now trying to learn just what kind of hyperthyroid patients will be aided by operation. His own experience had been that the most gratifying results were obtained from middle aged patients

who had had enlarged thyroids for many years and who had recently begun to suffer from the so-called symptoms of hyperthyroidism. He had had this winter two particularly satisfactory cases of this kind.

He referred to another patient who had shown remarkable improvement after ligation of arteries. She was a woman of 29 who had extreme symptoms of Graves' disease—large thyroid, exophthalmus—tremor—excessive perspiration—digestive disturbance—extreme nervousness, and rapid pulse, a condition too extreme for severe operative procedure. After ten days' rest in bed, however, the right superior thyroid artery was tied under local anæsthesia. To his surprise the pulse, which had usually been about 120 and had gone as high as 160, came down to 80 within a few days, and her other symptoms improved proportionately. He could not believe that the ligation of a single artery could produce this result and believed there must have been a nervous element in the result. Two weeks later, as the pulse began to rise again, he ligated the left superior thyroid artery, but the improvement was not as marked as before. A month later he removed the right lobe of the thyroid and the isthmus under local anæsthesia, a most trying procedure in this case. The patient has been greatly helped by these procedures.

In the acute cases of Graves' disease any operative procedure under either local or general anæsthesia may be decidedly dangerous. His best results have been obtained by securing the services of a very skilful professional anæsthetist and trusting him with the anæsthesia.

DR. JOHN ROGERS said that judging from his own experience with cases of thyroid enlargement, there would be a relapse in all the cases shown by Dr. Peck, except, possibly, in the first one, where the pathological changes were largely confined to the lobe that had been removed, and where the opposite lobe was not much affected. The two other cases of exophthalmic goitre Dr. Rogers said he did not consider cured, and the probabilities were that if either of them became pregnant, they would suffer from toxæmia. He could recall, perhaps, seven cases of this kind where the patients subsequently became pregnant, and all of them suffered from violent toxæmic or eclamptic symptoms, resulting in five abortions and two deaths.

In doing the radical operation for thyroid enlargement, one could venture no more than a guess as to whether the outcome would prove fatal or not. It was sometimes even impossible to tell the nature of the pathological changes without the aid of the microscope. In youth, thyroidectomy was much worse borne than in middle age. In dealing with a symmetrical enlargement of the thyroid, the speaker said he did not think an excision should ever be done, and the same was true of thyroid enlargement in the young. Youth should not be thyroidectomized, and in such cases the ligation of all four arteries would usually be followed by a disappearance of the goitre. This applies to simple colloidal goitre as well as to the goitre of Graves' disease.

DR. ARPAD G. GERSTER said the curious experience related by Dr. Dowd, where there was a marked improvement in the symptoms following the ligation of one superior thyroid artery, might perhaps have been due to the very pronounced variation that sometimes existed in the size of these arteries: one might be the size of a knitting needle, while the other might be as large as the external carotid, and it was possible that in Dr. Dowd's case the artery that was tied was unusually large, and was the principal source of supply to the gland.

Dr. Gerster said that of the extreme cases of exophthalmic goitre, those that showed the worst forms of hyperthyroidism, he could recall only one case of death after operation, and in that instance the patient was literally overwhelmed, the pulse becoming so rapid shortly after the operation that it could not be counted. That occurred in the days when chloroform was the favorite anæsthetic. While chloroform, in these cases, might be safe in expert hands, it was most dangerous in the hands of the inexperienced.

Dr. Gerster said that during the past winter they had at Mt. Sinai Hospital a case of extreme hyperthyroidism, the exophthalmus being so far advanced that the cornea became damaged. A day was set for operation, but in expectation of this the patient became highly excited and died before the time of operation arrived. With this experience in mind, another patient with pronounced exophthalmic goitre was admitted, and in this case, without letting the patient know that an operation was contemplated, he was, according to the plan of Crile, induced to

inhale a small quantity of ether every day under the belief that it was a remedial measure. The amount of the ether was gradually increased, until several times he was wholly under its influence, and finally the superior thyroid arteries were tied. He made an excellent recovery: his pulse, which had been as high as 180, had fallen practically to normal, and the exophthalmus had receded to a very great extent. Whether the improvement would be permanent remained to be seen.

DR. WALTON MARTIN said that two years ago he operated on a negro woman with extreme hyperthyroidism, removing one-half of the thyroid, and following the operation she improved to such a remarkable extent that he had shown her at one of the meetings of this Society. Subsequently she became pregnant and after her delivery became rapidly worse. She returned to the hospital and died there, thus confirming Dr. Rogers's statements.

It would be interesting, Dr. Martin said, if we could see these cases of Dr. Peck's several years after these operations had been performed.

DR. A. S. VOSBURGH said that in one case he had seen a girl about 25 years old, who was referred to him by Dr. Dudley S. Conly, there was a distinctly enlarged thyroid, with rapid heart action, sweating, tremor and diarrhœa, but no exophthalmus. In this case he ligated both superior thyroids under ether, and as she was coming out of the anæsthetic she became markedly cyanosed, the condition lasting for an hour and a half after the completion of the operation. There was no accompanying change in the pulse rate or respiration. The speaker said he was at a loss to account for the condition: it seemed to be the direct result of the double ligation. The patient's further recovery was uneventful.

DR. PECK asked Dr. Rogers if there was anything in the theory that most cases of exophthalmic goitre underwent retrogressive changes? If that was so, did not a partial thyroidectomy favor such retrogressive changes in the remaining lobe, and hasten the colloid or so-called "resting" state?

DR. ROGERS said that by the so-called retrogressive changes referred to by Dr. Peck he did not understand that their occurrence implied a cure. A cure, as he understood it, took place when the thyroid returned to its normal condition, and this did

not include those cases where it assumed the colloid state. All goitres, when their bearers are subjected to excessive fatigue, are prone to take on the changes, and give rise to the symptoms characteristic of Graves' disease. It simply underwent degeneration and became an ordinary goitre. In these cases of Graves' disease we had to deal not with disease of the thyroid alone, but of several organs which were probably more or less intimately connected with the thyroid.

GANGRENOUS APPENDICITIS WITH RESECTION OF FOURTEEN INCHES OF ILEUM.

DR. IRVING S. HAYNES presented an unmarried woman, 53 years old, who was referred to him on November 25, 1911, by Dr. W. J. Jones. She had passed the menopause five years ago, and enjoyed good health until three days ago, when she was seized with a sudden, severe epigastric pain, followed by vomiting and diarrhoea, which was very profuse. She fainted during the attack. The vomiting and diarrhoea continued all day, and the pain, which was at first generalized, gradually became localized in the lower abdomen. The attack occurred at her place of business, and the ambulance surgeon who was called to attend her gave her a hypodermic of morphine and took her home.

When Dr. Jones saw her on the following day she was fairly comfortable, with a temperature of 100 and a pulse of 90. She complained of some pain in the lower abdomen. On the following day she was much the same; the bowels had not moved, and there was some abdominal distention.

When Dr. Haynes saw the patient, on November 25, the patient's temperature was 101; pulse, 90. The bowels had not moved for three days. There had been no further vomiting since the onset of her attack. The abdomen was slightly distended and everywhere tympanitic. The area of liver dulness was normal. Over the lower abdomen, deep pressure excited muscular spasm and caused pain. No mass could be made out anteriorly, but upon rectal examination the pelvis was found to be filled with a mass which gave a sensation like fluid under tension. It was smooth and elastic, and so tender that a thorough bimanual examination could not be made.

The case was regarded as one of probable ovarian cyst with

twisted pedicle, and the patient was transferred to the Red Cross Hospital, where an operation was done that evening. Upon opening the abdomen and raising the omentum from the pelvis, there was a gush of muco-purulent fluid, followed by pus and liquid fæces, which had the characteristic colon bacillus fecal odor. The entire pelvis was filled with this fluid, imbedded in which were coils of small intestine glued together with foul lymph. A large, sloughing appendix was found in the right, postero-lateral angle of the pelvis, below the brim, and massed about it were coils of the terminal ileum, which showed three necrotic areas, each about three by one inch in extent, and all three confined to the last twelve inches of the gut.

The appendix was removed, together with two concretions which it contained, its base ligated and cauterized with carbolic acid and alcohol. The ileum was sectioned within one inch of the ileocæcal valve and inverted into the cæcum by a Pagenstecher running stitch. Fourteen inches of the ileum were resected and a side-to-side anastomosis made between it and the cæcum by means of the Roosevelt clamp and the usual double row of sutures, leaving an opening nearly two inches long. The pelvic cavity was then sponged out and tube drainage through Douglas's pouch into the vagina established. The abdominal wound was then closed tight.

The patient was placed in the Fowler position and the Murphy drip started immediately after the operation. There was no post-operative nausea nor vomiting. Flatus and fæces were passed per rectum at the end of 24 hours, and the bowels operated well at the end of 48 hours following an oil enema. After that the bowels acted without any difficulty, an enema being given now and then while the patient was confined to bed. The vaginal tubes were removed at the end of the first week. The patient's convalescence was hindered by an infection of the fascia covering the rectus muscle, which sloughed out for a distance of fully an inch and a half on either side, resulting in a gap between the recti muscles through which the abdominal contents bulged. She was now wearing an abdominal belt which held in the hernia, and which was satisfactory to the patient.

Present condition of the patient is perfectly normal. Her bowels operate, without laxatives, once or twice a day. Her general health is good.

ACUTE PALMAR BURSTITIS, WITH REMOVAL OF RICE BODIES.

DR. HAYNES presented a man, 21 years of age, who while cranking a car last summer, received a back kick that sprained his right wrist. The wrist was strapped and he was only slightly inconvenienced for a time. Later, however, after much use of the arm, he would suffer from pain at night and the hand became numb and cold. Both the hand and wrist had gradually become swollen, and the pain was more severe.

When the patient was referred to Dr. Haynes by Dr. W. J. Jones, on March 28, 1912, examination showed that the right hand and wrist were swollen, tense and somewhat tender over the area of the great palmar bursa, and extending down into the base of the little finger and for an inch and a half above the wrist joint. Pressure above and below the annular ligament would drive the fluid beneath the ligament with a coarse thrill from one sac into the other. The fingers could not be closed.

The case was regarded as one of acute traumatic bursitis of the palmar sac, and on March 16 the bursa was aspirated and a small quantity of fluid withdrawn. Upon examination, this proved to be negative. About two drams of a two per cent. solution of formaldehyde in glycerine was injected into the bursa, and worked well into the various parts of the sac. The hand was then placed on a splint and firmly bandaged. This procedure produced a moderate local reaction, and was followed by considerable pain. For ten days a rubber elastic bandage was used for half an hour at a time many times a day without appreciable benefit.

On March 29, under gas and ether anæsthesia, the bursa above the annular ligament was opened through a one-inch incision, just at the inside of the tendon of the palmaris longus. The interior of the sac was deeply injected, probably as the result of the formalin injection, and rice bodies at once became visible. With a scoop, these were carefully removed from all parts of the large bursal sac. Access to the palmar portion of the sac was obtained through the isthmus beneath the annular ligament. After the removal of about half an ounce of these rice bodies, the entire sac was treated with an injection of a five per cent. tincture of iodine solution, the excess afterwards

being squeezed out. Two sutures were inserted loosely to permit free oozing from the wound, and the hand was put up in a splint and not dressed until the seventh day. There was primary union throughout the wound excepting at one point where the oozing persisted slightly. With the removal of the sutures, the relief from pain was immediate, and motion was now returning.

DR. GERSTER said he had seen perhaps a dozen cases of acute palmar bursitis, some of them dating back as far as 1884, when we first began to make extensive dissection in this region. In cases of recent origin, these so-called rice bodies were not found in the sheaths. These vegetations were not unlike papillomata, and strongly resembled those sometimes found on the inside of the knee joint. They originated from the edge of the bone just where the capsule was inserted into the tibia, and gradually become detached as free bodies. Prior to their detachment from the bone they are very vascular, bleeding readily. Later, certain portions undergo calcification, and they become these rice bodies.

Dr. Gerster said that in one very extensive case which he had in mind occurring in a physician, the entire bursa in both hands was involved and extending underneath the carpal ligament up into the forearm. It was very difficult to gain access to the parts adjoining the carpal ligaments and hence in order to remove the rice bodies it was necessary to resort to an expedient not unlike that employed in cleaning lamp-chimneys; that is, taking a rubber tube and drawing it back and forth underneath the carpal ligaments. In this case the operation was done many years ago, and when Dr. Gerster saw the patient recently, the motion of the hand was perfect. These patients should be instructed to exercise the affected parts regularly from the very day of the operation. Putting up the hand in a fixed splint and leaving it so for even ten days was a mistake, as firm adhesions were very apt to occur.

Dr. Gerster asked Dr. Haynes if a microscopic examination was made in this case. He always had a suspicion that many of these cases had a tubercular origin.

DR. HAYNES replied that a microscopic examination was made and failed to show any evidences of tuberculosis. In this case the rice bodies were all loose in the palmar bursa, and were scraped and wiped out.

SUBLINGUAL THYROID.

DR. HAYNES presented a girl, eighteen years old, whose previous health had been excellent. In October, 1910, she had a cold and sore throat, and upon inspection of the throat she saw a large lump at the back of the tongue. She had never been conscious of this before, and since its discovery it had steadily increased in size.

The patient came to the Harlem Hospital, on November 2, 1911, and entered the throat class of Dr. Lester M. Hubby, by whom she was referred to Dr. Haynes. There was a noticeable bulging underneath the chin. On opening the mouth there was at once observed a large elevation behind the tongue, between the posterior pillars. When the tongue was drawn out, there was seen a round tumor at its base, projecting fully an inch upward and backward, leaving very little space between the tongue and posterior pharyngeal wall. The tumor was covered with a very dusky mucous membrane through which a perfect network of blood-vessels were conspicuous. The patient's voice was flat and husky, and there were constant swallowing movements.

Palpation of the tumor was unsatisfactory, for the mere act of introducing the finger into the mouth induced an attack of dyspnœa, with severe coughing and choking. It could be made out, however, that the tumor was very tense, with a sense of elasticity instead of fluctuation. It was located at the base of the tongue, just above the hyoid bone, and was fixed in its position. The glands of the neck were not enlarged. There were no evidences of any inflammatory condition in or about the throat. The growth was not painful, and only caused symptoms by reason of its size and position. The rest of the neck seemed normal, and Dr. Haynes said he thought he could detect the existence of the thyroid in its usual position.

The case was regarded as one of thyro-glossal cyst or dermoid, and the patient was operated on November 9, 1911. The anæsthetic, which consisted of nitrous oxide gas followed by ether through the glass nasal tubes, was administered by Dr. J. E. Lumbard, the hospital anæsthetist. Dr. Haynes said he had planned to enucleate the tumor through the floor of the mouth, but as soon as the patient became unconscious, the tongue

dropped back, and, with the growth, arrested breathing. This was overcome by two traction ligatures through the tongue, but the drawing of the tongue forward, even with the jaws widely open, so filled up the space that there was no chance to operate by this route. An incision was thereupon made externally in the median line from the symphysis to the hyoid bone, and the muscles separated until the tumor was reached. It lay buried in the structures at the base of the tongue, and instead of having a fibrous, non-vascular capsule, as he had expected, he came upon a very vascular, deeply injected wall almost one-eighth of an inch thick, to all appearances like the capsule of a very vascular hypertrophied thyroid. This was incised in the middle line, when the tumor mass protruded through the incision, showing that it was under considerable pressure. With the finger it was quickly and easily separated from its capsule and then removed with a fenestrated spoon forceps. The hemorrhage caused by this procedure, as well as during the incision of the capsule, was profuse, and was first controlled by firm packing of very hot sponges and later by the ligation of two spurting arteries at the lower, posterior part of the bed of the wound. This fully controlled the bleeding. There seemed to be some of the gland tissue left in the back part of the cavity; accordingly, the tissues were picked up and excised. This proved to be the tissues covering the gland posteriorly, and an oval area was taken out, about an inch by three-quarters, and the opening sutured with plain catgut. As the wound had opened into the mouth, a small rubber tissue drain was inserted, the muscular layers were closed with plain catgut and the skin with silkworm. The patient made an uneventful convalescence, and left the hospital on November 9.

The post-operative course of the patient was very interesting. On November 24 she had an attack of dizziness, falling off the chair apparently in a faint. She complained of pain in the back of the head and said she could not see. She was nauseated and vomited during the night. On the following day she felt weak and sick and could not leave her bed. She refused all food. On November 26, when Dr. Haynes saw her again, her temperature was 101; pulse, 100. She lay huddled up in bed with the covers drawn tightly around her, with her eyes closed in a "dopy" state. She could be aroused and answered when spoken

FIG. 1.



Photograph of the sublingual thyroid after removal (Case I).

to, but volunteered no information and paid no attention to her surroundings. Otherwise, the examination was negative.

Thinking that possibly he had removed her only active thyroid, Dr. Haynes put the patient on thyroid extract, in tablet form, and under this medication she had steadily improved. She had gained in weight, her menstruation was normal and the bowels regular. She had had no further dizzy spells nor other symptoms. A slight keloid condition was developing in the scar.

The tumor removed (Fig. 1) measured 2×1.5 inches, and had a thickness of about one inch. On its posterior surface there was a shallow groove, which divided it into two distinct lateral lobes. The entire gland was uniformly enlarged and had a soft, gelatinous appearance. Microscopically, the most prominent change consisted of a diffuse, colloid degeneration. There were no evidences of inflammatory changes. No structures resembling the parathyroid glands could be found.

DR. ROGERS said the patient shown by Dr. Haynes had evidently suffered from the effects of dysthyroidism, by which was meant imperfect development and function of the thyroid gland, and which differed from both hypo- and hyperthyroidism. In some of these cases there was a loss of smell.

OLD FRACTURE OF THE PATELLA.

DR. JAMES H. HITZROT presented this case. The patient was a man who came to the House of Relief last month for another condition. He gave the history that fourteen years ago he fractured both patellæ. He was treated at the Massachusetts General Hospital by non-operative means, and three years later he sustained a re-fracture of the right patella. In spite of the wide separation of the fragments at the present time, as shown by the X-ray, the functional result was excellent.

DR. N. W. GREEN said that while in Liverpool in 1894, Robert Jones referred to the method of treating fracture of the patella by massage. Wharton Hood had claimed that with ligamentous union, the wider the separation of the fragments, within reason, the better the function.

DR. A. V. MOSCHCOWITZ said that about two or three years ago he showed a case of old fracture of the patella where the fragments were separated fully four inches, and in spite of that,

function was so good that the patient could hop on the foot of the affected side for quite a distance.

The speaker said he now had under his care a boy of twelve years who about two months ago fell on the sidewalk and injured himself. He was taken to a hospital and kept there for two weeks, and then discharged with a small wound in front of the patella. When he was subsequently brought to the Har Moriah Hospital, the leg was ankylosed at an angle of 120 degrees. Examination showed that the patella was fractured; the upper fragment was no larger than a marrow-fat pea, while the lower fragment, which consisted of the rest of the patella, was inside of the knee joint. The joint was exposed, and upon raising up the capsular extension of the quadriceps extensor tendon, it was seen that the crucial ligaments were torn. Upon carefully lifting the main fragment of the patella out of the joint, it was found that the anterior surface of the patella articulated with the under surface of the femur, while the posterior surface of the patella articulated with the upper articular surface of the tibia. After suturing the parts in their proper position, the wound was closed. Primary union resulted, and the boy now had limited motion of about 40 degrees. He was at present being anæsthetized about once a week for the purpose of breaking up adhesions.

DR. HITZROT said he had seen a number of cases of old neglected fractures of the patella, but in none of them had the functional result been as excellent as in this instance. He had at present under his observation two cases where the fragments were four and six inches apart, respectively, and the patients were able to walk about and even climb stairs. In the case he presented to-night the man had been under treatment nineteen months before he was able to use the limb.

BONE TRANSPLANTATION AND THE USE OF A RIB AS A GRAFT.

DR. CLARENCE A. McWILLIAMS read a paper with the above title, for which see page 377.

In connection with his paper, Dr. McWilliams showed two cases upon whom he had operated by the method described.

DR. GERSTER said that in the case shown by Dr. McWilliams, where one-half of the lower jaw was removed, it might have

been expedient, in view of the youth of the patient, to take part of the rib, and producing a greenstick fracture, mould its shape to correspond to the angle of the jaw, thus giving a better cosmetic effect.

Stated Meeting, held at St. Luke's Hospital, April 24, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

LONG LASTING CURE AFTER EXCISION OF CANCER OF RECTUM.

DR. ROBERT ABBE presented a woman who was operated on by him almost ten years ago for a carcinoma which nearly closed the rectum and involved the upper vaginal wall. A left inguinal colotomy was done, and the distal end closed and dropped back into the peritoneal cavity. In the lithotomy position an incision was made around the anus and through the perineum; this permitted perfect access to the sacral mass by cutting away also the vaginal wall involved with the rectum. The recto-sigmoid junction above the cancer was cut off and left open in the upper vagina. The perineum was sutured continuously with the anal incision.

Although the sigmoid colon, closed at the top, opened into the vagina, no mucus was ever secreted from it. The artificial anus had always remained, with perfect control. The patient was in good health at the present time.

LONG LASTING CURE AFTER REMOVAL OF SARCOMA OF THE KIDNEY IN INFANCY.

DR. ROBERT ABBE presented a patient who, at the time of operation, in 1892, over twenty years ago, was an infant one year old. At that time a large growth springing from the upper pole of the right kidney, the capsule of the kidney being continuous with that covering the tumor, was removed. It proved to be a solid, sarcomatous structure, softer and semi-cystic in parts, resembling, as did many "Grawitz" tumors, a section of firm tomato. Upon removal, the tumor weighed seven and a half pounds—just one-half the weight of the infant after its removal, which was fifteen pounds.

The growth was submitted to Dr. Edward K. Dunham for

pathological examination, and he pronounced it a "rhabdomyo-sarcoma." The occasional occurrence of muscle cell among the renal and predominating sarcoma tissue was not unlike many of the malignant growths. One unusual feature of the case was that while the growth was incorporated with the upper part of the kidney, the lower half was apparently free, and Dr. Abbe ventured to amputate this, and closed the cut section by continuous catgut suture. The child's recovery was prompt. Twenty years had elapsed since the operation, and the patient was still in perfect health.

Dr. Abbe said this case would seem to be unique in the history of surgery. In Janesco's elaborate work on tumors of the kidney, published twelve years ago, he reviewed the histories of similar cases after a thorough search of European and general literature, and found none that had lived as long as this one, who had then survived six and a half years.

PERMANENT RECOVERY AFTER REMOVAL OF CANCER OF THE THYROID GLAND.

DR. ABBE presented a man who was operated on five years ago for a growth of the thyroid measuring about the bulk of two adult fists and extending well up the left side of the neck. It involved the middle lobe and gave rise to oppression in breathing. Dissection proved difficult, on account of the dense adhesions to the trachea. The right lobe of the thyroid was not involved. Pathologically, the growth proved to be a solid carcinoma, with little or no colloid change.

PAPILLOMATA OF THE LARYNX CURED BY RADIUM.

DR. ABBE showed a young woman of 18 years whose remarkable restoration of voice was shown by her perfect rendering of the scale. Almost two years ago she became husky and had a fibroma removed from the left vocal cord. There was a rapid recurrence, and two months later a second, larger growth was removed. Within a few months after this, extensive papillomata grew at the same site, covering one vocal cord and a part of the other. Her speaking voice had already been entirely lost, and there were evidences of respiratory obstruction.

The patient was admitted to St. Luke's Hospital, where Dr. Abbe applied radium in the following manner, in June, 1911. It had been found impossible to use it without anæsthesia,

owing to an extremely sensitive larynx, even after the application of cocaine. Under ether anæsthesia, a tracheotomy was done, and a wire passed up through the larynx to the mouth. By this means, a capsule containing one hundred milligrams of pure radium was held suspended accurately between the vocal cords for half an hour, while the anæsthesia was continued. No other treatment was given. The tracheotomy wound was quickly closed and the patient returned home. There was a steady improvement in her voice during the next three months until it returned to its present perfect form.

Laryngoscopic examination showed a restoration of the vocal cords to their normal condition, and there was at present no trace of papilloma. Ten months had now elapsed since the application of the radium, which Dr. Abbe remarked was likely to be as perfect a specific for laryngeal papillomata as it was for warts of other parts of the body.

CANCER OF THE PENIS.

DR. CHARLES L. GIBSON presented a man, 27 years old, who was admitted to St. Luke's Hospital on August 20, 1906. He gave the history that six months before, he had been circumcised, and soon afterwards a small ulceration appeared on the glans, gradually spreading until it involved the whole anterior portion of the penis. It was painless, and micturition was not disturbed.

Operation: Excision *en bloc* of the inguinal nodes (which proved normal on microscopic examination), the corpus spongiosum to the pubes, and both crura of the corpora cavernosa. A meatus was established on the anterior surface of the scrotum. A plastic operation of scrotal flaps to be joined as an efferent canal to the meatus failed. Microscopically, the growth proved to be carcinoma. The patient had remained free from recurrence and the anterior meatus functionated well.

Dr. Gibson said he thought that cancer of the penis was a condition easily curable, providing one did as radical an operation as he had described.

CANCER OF THE MALE BREAST.

DR. GIBSON presented a man of 62, who was admitted to St. Luke's Hospital in March, 1908, complaining of a "lump" which

had appeared in the right breast four months ago. There was no history of injury. Inspection showed a hard mass, two inches in diameter, to the right of the nipple. The centre of this mass was ulcerated. No enlarged nodes were felt in the axilla.

A radical removal of the growth was done, and the resulting deficiency was filled by skin grafts two weeks later. The patient was discharged on April 15, 1908. Microscopically, the growth proved to be carcinoma.

Shortly after this patient's discharge, he contracted a severe attack of erysipelas. Dr. Gibson said he had been struck by the apparent influence of *true* erysipelas in inhibiting the recurrence of carcinoma, whereas the artificially induced process was ineffectual. This patient had remained free from recurrence up to the present time.

COMPLETE EXCISION OF ONE STERNOMASTOID MUSCLE FOR TORTICOLLIS.

DR. GIBSON presented a boy of twelve, who was shown to demonstrate the excellent functional and cosmetic results resulting from complete excision of one sterno-mastoid muscle two years previously. When the patient applied for treatment he had an extensive cicatricial contraction of one sterno-mastoid resulting from an infection that had necessitated repeated operations.

Ten days after the excision of the muscle, good movement of the head was obtained, and there had never been any relapse. At present, the boy's head was maintained in the correct attitude when at rest, and all motions were as free as in the normal individual.

DR. ROBERT T. MORRIS suggested the removal of both sterno-mastoid muscles in cases of torticollis where the affection was not of reflex origin. When only one was removed, it might take a long time for the patient to regain his muscular balance, and symmetry would be favored by the double operation.

CHRONIC EMPYEMA: DELORME-SCHÉDE OPERATION.

DR. WALTON MARTIN presented a man who had suffered from chronic empyema, with a thoracic fistula, of seven years' duration. There was a communication with the lung, and

methylene blue, injected into the sinus, was immediately coughed up. Dr. Martin said he had already shown this patient at a meeting of the Society about a year ago, after a Schede-Delorme operation had been performed, the 3d, 4th, 5th, 6th, 7th and 8th ribs, together with the parietal pleura and a portion of the pulmonary pleura, being removed. Subsequent to that operation, he improved very much, gaining in weight and strength, but he continued to expectorate pus.

Three months ago the thoracic wall was opened over the second rib, and the cavity communicating with the lung was injected with iodoform filling (Moesitig), consisting of iodoform, spermaceti and oil of sesame. The X-ray showed the iodoform in the sinus—almost as distinctly as it would bismuth.

During the past month the patient had been free from cough, and had returned to his work as a hod-carrier.

DR. MARTIN presented a second case of chronic empyema, communicating with the lung, where portions of the 6th, 7th and 8th ribs were removed, together with the pulmonary pleura. About four weeks later the sinus was injected with a 33 per cent. mixture of iodoform in vaseline. The sinus was now closed, but the patient was still expectorating small quantities of pus. Since the injection of the iodoform he had gained about fifteen pounds in weight. In neither of these cases were there any symptoms of iodoform poisoning.

DR. MARTIN'S third patient was a man, 20 years old, who had undergone two operations for empyema. The first operation was done three years ago. Six months ago, under ether anæsthesia, the 2d, 3d, 4th, 5th, 6th, 7th and 8th ribs on the left side, together with the parietal pleura and a strip of pulmonary pleura, were removed. This allowed the lung to expand, and the chest wall to come in contact with it.

The patient made a rapid recovery, and was now in good health. There was a moderate curvature of the spine, which was gradually disappearing.

SIMPLE ULCER OF THE COLON: PERFORATION.

DR. HENRY H. M. LYLE presented a woman, 26 years old, who was admitted to St. Luke's Hospital in October, 1909, with the diagnosis of acute appendicitis, with abscess. The history

and clinical findings on admission appeared to be those of an acute suppurative appendicitis engrafted on a chronic appendicitis. On admission, her temperature was subnormal and the pulse rate 92. A blood count showed 25,000 white cells, with 86 per cent. of polymorphonuclears.

An incision was made over the mass, and a large abscess containing fecal matter was evacuated. On the inner wall of the cavity, about two inches above the cæcum, there was a large, oval, indurated ulcer, in the centre of which was a perforation, with necrotic edges. The edges were trimmed, a section removed for examination, and the perforation was closed. The appendix was outside of the cavity and apparently had nothing to do with the condition, but as it might have been the source of the infection, it was removed. A small rubber dam drain was inserted and the wound was closed. The patient made an uneventful recovery, and left the hospital 23 days later. Microscopically, the appendix showed nothing abnormal, and the section from the ulcer showed it to be a simple ulcer of the colon.

On March 12, 1912, the patient returned to the hospital for the correction of a ventral hernia springing from the scar of the former operation. When this operation was done by Dr. Gibson, the only evidences found of the former ulceration were a few fine adhesions on the colon. The picture presented by the original condition was so striking that one might have believed he was dealing with a gastric perforation. After the operation, a more detailed history was obtained, and it was then learned that the patient had long been a sufferer from indefinite gastric symptoms. She had made the rounds of the clinics, and her condition had been variously diagnosed as ulcer of the stomach, gall-stones, floating kidney, chronic appendicitis and cancer.

Dr. Lyle, in connection with this case, said that, both embryologically and anatomically, the cæcum and the ascending colon can be considered as the stomach of the large intestine. Considering this functional relationship it is not strange that lesions similar to those of the stomach are occasionally discovered in the big gut. There is in the large intestine a simple ulcer whose fundamental characteristics bear a striking resemblance to those of a gastric ulcer. This condition was described by Cruveilhier (in 1830), Marchesseux (1837), Rogie (1838), and

Lebert (1855). Their observations were mainly pathological in character and did not attract much clinical notice.

In 1902, Quénu and Duval published a monograph, "*L'Ulcere Simple du Gros Intestin*," which did much to rescue this little known affection from the pathological chaos of the large intestine.

These simple chronic ulcers are analogous in all points to those of the stomach and they have all the anatomical-pathological characteristics which distinguish a round ulcer of the stomach from other ulcer; it is a simple ulcer of the large intestine, bearing no relation to ulcerative colitis, tubercular, syphilitic or stercoral ulcers.

Quénu and Duval reported 31 cases from the literature. The ulcer was single (20 times in 31 cases) but was found also associated with analogous lesions in the stomach and duodenum. Of 31 cases 23 perforated.

INTRACTABLE BRACHIAL NEURALGIA.

DR. LYLE presented an engineer, 43 years old, who entered St. Luke's Hospital in November, 1910. He gave the history that three months previously he had been struck on the right side of the neck, resulting in complete paralysis of the right arm, and in intense, persistent pain in the arm and hand. An exploratory incision was made over the brachial plexus, and subsequently the arm was amputated. The patient's chief complaint, on entering the hospital, was the insufferable pain in the hand and arms of the amputated limb, which had been disarticulated at the shoulder. There was a vertical scar, two and a half inches long, at the anterior border of the sterno-mastoid; the scar was freely movable and the stump was not sensitive to pressure. The bony parts appeared to be normal, excepting for a slight prominence of the left clavicle and upper ribs, and a moderate lateral curvature of the spine.

The patient was examined by Dr. Pearce Bailey, who recommended a unilateral intra-spinal division of the left seventh and eighth cervical and first dorsal posterior nerve roots, and on December 1, 1910, Dr. Lyle did a unilateral laminectomy and divided these roots. In the course of the operation, which was done according to the method described by Dr. Alfred S. Taylor, the posterior root of the sixth cervical nerve was found to be

torn away from the cord. The dura was sutured with fine cat-gut, and the wound closed.

There was a moderate post-operative reaction. The patient remained free from pain for five days, and then began to complain of pain in the thumb, hand and arm. This gradually increased in severity, and in the course of two months it was, if anything, more intense than before the operation.

As an explanation of the failure of posterior root section to cure certain of these cases, it had been stated that there were additional sensory paths in the anterior roots, and that under those conditions these sensory paths must be cut to obtain a cure. With this point in view, and as this appeared to be an ideal case, as the arm was missing, Dr. Taylor cut the anterior roots six months after the original operation. This operation also failed to relieve the man's pain.

GLUTEAL ANUS, FORMED BY PASSING THE RECTUM THROUGH THE FIBRES OF THE GLUTEUS MAXIMUS.

DR. LYLE presented a man, 57 years old, who was operated on fourteen months ago, when the anal canal and its musculature were removed for carcinoma. The patient's control of this artificial anus had been exceptionally good; he had had only one slight accident since the operation, and he wore no artificial mechanical support, but despite the excellent functional control, the anus presented a drawback that seriously interfered with its usefulness. After walking or standing for some time, the patient began to suffer from cramps in the calf of the leg, and pain along the course of the great sciatic nerve. Toward the close of the day, this pain became unbearable, and he was compelled to lie down and rest until it disappeared. In the morning, he started to work in good condition and returned at night exhausted by the pain. A careful physical and X-ray examination showed no signs of a recurrence of the growth, and the only explanation Dr. Lyle could offer was that the irritation of the artificial anus, which was controlled by the fibres of the gluteus maximus, was greatly increased by walking, and in turn set up a reflex disturbance in the great sciatic nerve.

Dr. Lyle said that in studying the literature of the reported cases of this form of anus, no mention was found of this complication.

LARGE SADDLE ULCER OF THE STOMACH: HOUR-GLASS CONTRACTION.

DR. W. S. SCHLEY presented a woman, 34 years old, who entered St. Luke's Hospital on February 8, 1909, with the history that five months before her admission she had begun to suffer from attacks of vomiting after meals, preceded by a loss of appetite and indigestion. After some weeks these symptoms were followed by pain, with eructation of gas, and finally she could take no solid food. She entered the Newport Hospital and was there for two months, being somewhat improved by a restricted diet. Since coming to New York she had complained chiefly of pain, which was worse after eating and radiated through to the back. There had been obstinate constipation, and the movements had been dark in color. She had lost considerable weight, and was now very poorly nourished, with a thin, shrunken abdominal wall, and marked tenderness over the epigastrium and left hypochondrium. The gastric analysis showed much fermentation and an atonic condition of the secreting apparatus. The stomach was very slow in emptying itself. A blood test showed 55 per cent. of hæmoglobin.

Upon operation, the stomach and lesser omentum were found adherent to the anterior abdominal wall under the left rectus muscle. Freeing these structures left an opening in the stomach about three inches in diameter, through which the interior of the stomach could be thoroughly inspected. An ulcer was seen extending down the posterior surface, and the large defect there had been closed by an adherent pancreas. This large indurated area presented a red glazed surface, without induration at the edges and without evidences of bleeding. The ulcer area was about the size of the palmar surface of the adult hand. The pylorus was entirely patent.

The advisability of doing a gastrectomy or gastro-enterostomy was considered, but the patient was in no condition to stand either procedure. The stomach opening was thereupon closed vertically, the last sutures posteriorly being taken in the pancreas itself, thus restoring the normal contour of the stomach. A subsequent operation was contemplated, but the patient's condition improved so rapidly and her progress was so entirely satisfactory that further interference was deemed unnecessary.

Since the operation she had gained 45 pounds in weight; she was the picture of health and entirely free from pain.

Dr. Schley said this case was shown because of the enormous size of the ulcer, the fact that her pain was entirely due to the adhesions to the parietal peritoneum and to the stomach fermentation, resulting from imperfect drainage.

SADDLE ULCER OF THE STOMACH: GASTRO-ENTEROSTOMY.

DR. SCHLEY presented also a man who for nearly three years prior to operation had complained of the usual gastric symptoms, *i.e.*, eructations of gas, pain and occasional vomiting. During the last year the attacks of pain had become more frequent, coming on with increasing severity within an hour or two after eating. His loss of weight was progressive. Examination showed an area of tenderness in the mid-line of the epigastric region, and here an indefinite mass could be made out. There was no history of blood in the vomitus or stools. The diagnosis lay between gastric ulcer and carcinoma of the anterior wall. Upon operation, an indurated ulcer the size of a silver dollar was found on the anterior wall, near the lesser curvature. There was considerable inflammatory induration. A posterior gastro-jejunostomy was done, and following this the patient's improvement was immediate. He had remained entirely free from pain and symptoms of gastric disturbance, had regained his lost weight and was now working daily.

PERFORATING ULCER OF THE STOMACH: LATE OPERATION.

DR. SCHLEY presented a man who about a year prior to his admission to St. Luke's Hospital had suffered from a gastric hemorrhage. A month later he began to have epigastric pain, which was aggravated by taking food. He had eructations and morning retching, and frequently vomited at night, which relieved his pain. There was loss of weight and strength. He had noticed that his stools were occasionally black in color. His pain was very constant, and for two weeks prior to his admission to the hospital it had been particularly severe. Four days before his entrance, while undressing one evening, he was taken with a sudden severe pain, with prostration and retching. He visited a hospital, where he was treated for gastritis, but there was no improvement in his symptoms.

On admission to St. Luke's Hospital, he had the appearance of one suffering from severe peritonitis, and his history made the diagnosis of perforating ulcer reasonably clear. Upon operation, a small ulcer was found on the anterior wall, two and a half inches from the pylorus. There was a small perforation through its base. It was closed with two layers of purse-string sutures. The peritoneum was then washed out, the epigastric wound closed with through-and-through sutures, and drainage established through a small incision over the pubes. The man recovered, but had recently re-entered the hospital for the closure of an epigastric hernia which had resulted from the suppuration of his wound. He was now convalescent. During the course of this second operation it was of great interest to observe the site of the previous perforation and ulceration. This could scarcely be distinguished: all induration of the stomach wall had disappeared, and there were no adhesions about it. More or less extensive adhesions were encountered along the right side and under the liver, but the central part of the abdomen was practically clear.

CICATRICIAL CONSTRICTION OF PYLORUS.

DR. SCHLEY presented a man with an enormous dilatation of the stomach, the X-ray photographs showing that the greater curvature extended to within an inch and a half of the pubes. The stomach was slow in emptying itself, a very appreciable quantity of bismuth emulsion remaining in the stomach at the end of three days. For ten years this patient had suffered from symptoms of indigestion: at first, these attacks were mild and infrequent, but they gradually occurred with increasing frequency and were of longer duration. During these attacks he would vomit large quantities of a thin, acid fluid, and this would give him relief. Later, he had been obliged to relieve himself every night with the stomach tube, the material removed having a foul, fermenting odor, and being very acid. He had never vomited blood nor noticed any in the stools. There had been much loss of weight. No typical history of ulcer could be elicited.

Upon operation, it was found that the cicatrix of an old ulcer almost at the pyloric site had so closed that opening that its lumen was about the size of a very small lead pencil. Both the

Finney operation and a gastro-enterostomy were considered, but it was concluded that better drainage could be established by the latter procedure. The anastomosis was not made at the very lowest point of the greater curvature, but about four inches below the pylorus and large enough to admit three fingers. This proved entirely satisfactory, and the patient had been free from gastric symptoms since the operation. This, Dr. Schley said, was a case of true dilatation of the stomach from obstruction, and not a case of gastropsis.

TRAUMATIC RUPTURE OF THE JEJUNUM.

DR. SCHLEY presented a boy, nine years old, who, while playing, accidentally dislodged a large stone, which struck him over the abdomen. The ensuing pain and shock were very great, and he was taken to his home and an hour later brought to the hospital in an ambulance. Upon admission, there was still considerable shock, with marked rigidity of the abdomen and evidences of some fluid within the peritoneum. It was considered fairly certain that some visceral damage had been done, probably a rupture of the liver or intestines. He was immediately taken to the operating room, and upon opening the abdomen, a complete rupture of the jejunum, two inches from the duodeno-jejunal junction, was found. The abdominal cavity was filled with green bile, mixed with blood. The divided gut was united with a small button, re-inforced with a peritoneal stitch. The boy's convalescence was uneventful, and he left the hospital in four weeks. The button was passed on the seventh day.

INTESTINAL OBSTRUCTION: DOUBLE IMPLANTATION OF ILEUM INTO TRANSVERSE COLON.

DR. SCHLEY presented a woman who was admitted to St. Luke's Hospital on January 6, 1911. She had been operated on a year ago at another hospital for acute appendicitis, with abscess, and since that time she had suffered from abdominal pain, with increasing constipation. Her symptoms gradually became more frequent and severe, and for a week prior to her admission her bowels had not moved. For the past three days her pains had been unusually severe, with nausea and persistent vomiting. There was marked abdominal distention.

On operation, a dense mass of adhesions were found in the

right pelvic and iliac regions. These could not be untangled, and it was decided to do an enterostomy and to subsequently attempt a deliberate separation of the adhesions to restore the patency of the intestinal canal.

After four weeks' drainage, and when the general condition of the patient had markedly improved, the second operation was undertaken. It was found absolutely impossible to separate the dense adhesions without opening the intestine. The question then arose of dealing with the proximal and distal ends of the gut. After division of the gut, the proximal end was implanted into the nearest large intestine free from adhesions, which happened to be the mid-portion of the transverse colon. The distal opening was likewise implanted into the transverse colon, so that there might be no excluded area of small intestine. As the site of the enterostomy was only two or three feet from the ileo-cæcal junction, no disturbances of nutrition were feared.

This patient's restoration to health had apparently been perfect, and she now declared herself entirely free from any disturbances of the gastro-intestinal tract.

In addition to the above patients, Dr. Schley showed lantern slide pictures of eight cases of intestinal obstruction and resection.

DECOMPRESSION FOR BRAIN TUMOR.

DR. SCHLEY presented a woman, who for a year prior to her admission to St. Luke's Hospital had suffered from headaches, of increasing severity. Five months ago she had a severe attack of vomiting. For the past three months her eyesight had been failing, and she had complained of a continuous tinnitus in the left ear. There was a tremor and spastic condition of the left hand and arm. An examination of the eyes showed double choked disk.

In the absence of more definite localizing symptoms, a right temporal decompression operation was done, and the result thus far had been very satisfactory, with relief from the headaches, improvement of vision, and general comfort.

DR. ABBE referred to the good results that sometimes followed these decompression operations on the skull, irrespective of the exact localization. In one case of an indeterminate lesion of the brain which he saw about three years ago, the patient,

who was suffering from double optic neuritis, regained her eyesight after the decompression and had since remained apparently cured. In another case where the operation was done five years ago, there was no improvement in the optic neuritis, but the patient retains all faculties and is as happy as blind people usually are.

DR. ROBERT F. WEIR spoke of some of his earlier cases of brain surgery, which were done fully thirty years ago. In one of these cases much relief was obtained though he failed to reach the tumor. In conjunction with the late Dr. Edward C. Seguin a paper was published at that time on Brain Surgery, in which the suggestion was made to resort to a decompression operation on the skull in otherwise inoperable tumor cases. The suggestion fell flat. Now, it was looked upon as an accepted procedure.

DR. WILLY MEYER said that in one case of supposed cerebellar tumor that came under his observation lately, the only focal symptom was a slight left facial paresis. The entire cerebellum was exposed and carefully explored, with negative results. The patient died, and at the autopsy a large cyst was found in the left large hemisphere involving temporal and occipital lobe. Were it not that the sometimes dangerous consequences of aspirating the brain made surgeons fear the multiple use of the needle in intracranial operations, the cyst in this case might have been found and evacuated, inasmuch as the transverse sinus had been fully exposed. It may be of interest to add that the patient's mother died from a brain cyst.

CICATRICIAL STRICTURE OF THE ŒSOPHAGUS.

DR. N. W. GREEN presented a boy, three years old, who was admitted to the St. Luke's Hospital, in the service of Dr. Robert Abbe, in September, 1911, with the history that about a year prior to that date he had swallowed some lye. This resulted in an obstruction of the œsophagus, and finally, all solid food was regurgitated, the stricture being impermeable excepting to small quantities of fluid.

Two days after admission, a gastrostomy was done by Dr. W. S. Schley, and through this opening, nourishment was given to build up the patient. On November 3, 1911, with the aid of the œsophagoscope, Dr. Green was able to pass a filiform bougie downward through the stricture to the gastrostomy opening. A

silk string was then drawn down by Dr. Abbe, and the stricture dilated to the size of a No. 20 F. bougie by means of his string-sawing method. A few weeks later this procedure was repeated, and the opening increased to the size of a No. 34 F. bougie. Since the operation the boy had gained fifteen pounds in weight, and he was now able to take all his nourishment by mouth.

Dr. Green presented a second case of cicatricial stricture of the œsophagus in the person of a girl, three and a half years old, who was admitted to the hospital in November, 1911, with the history that nine months before she had swallowed some potash used for cleansing purposes, and that increasing dysphagia had resulted. On admission, the child was greatly emaciated, and an X-ray picture, taken by Dr. L. T. LeWald, showed a distention of the upper part of the œsophagus, with almost complete obliteration of the section below.

On November 27, Dr. Green did a gastrostomy, and about a month later, with the aid of the œsophagoscope, he introduced a filiform bougie downward into the stomach. Then, as in the previous case, a silk string was drawn down, and the stricture was divided by Dr. Abbe by the string-sawing method. This was continued until the œsophagus admitted the introduction of a No. 30 French bougie, and after that, a No. 28 bougie was passed about once a week.

The patient's gastrostomy wound was closed, and she was now taking all her food by mouth. The œsophageal stricture now admitted a No. 34 F. bougie.

ŒSOPHAGEAL STRICTURES.

DR. ABBE showed two very perfect X-ray bismuth pictures of œsophageal cicatricial strictures, where very tight strictures of the lower half of the œsophagus yielded to the string-cutting method. The œsophagus, of course, could not be restored in all its coats, but a competent fibrous tube, with flat epithelial lining, answered every requirement. Following this method of treatment, bougies must be passed at longer and longer intervals, until the contractile tendency ceased, which would occur.

Dr. Abbe said that the first case operated on by him by this method, twenty years since, had no recurrence, and bougies had not been required in recent years.

An X-ray bismuth œsophageal picture was shown of a central carcinomatous stricture, which, after cutting and dilatation, had been radiumized thoroughly by one hundred milligrams of pure radium inclosed in a lead and gold capsule two millimetres thick. The picture showed the radium *in situ*. The patient was now swallowing well, months after the obstruction was relieved, and had recently begged to have her useless gastric fistula closed.

DR. WILLY MEYER said that several years ago he presented before the Society a number of cases of stricture of the œsophagus in children which were treated by the string method. The speaker said he was able to keep these children under observation and in every instance, so far as he knew, the satisfactory results that were obtained were lasting. It was important, in all these cases, to insist upon the introduction of an œsophageal bougie at more or less regular intervals as routine measure in the after-treatment.

FOREIGN BODY IN THE ŒSOPHAGUS.

DR. GREEN presented a boy, two years old, who was admitted to the hospital, in the service of Dr. Abbe, in May, 1911, suffering from dysphagia. He vomited constantly, and could not even swallow water. An X-ray was taken, which showed a small, round object, like a button, lying opposite the eighth rib. An attempt was made to locate it with the œsophagoscope, but only an indefinite, dark object could be made out. An attempt was then made by Dr. Abbe to extract it with the coin-catcher, but this also proved unsuccessful. Another X-ray was then taken, which showed that the foreign body had become dislodged, and now lay in the stomach. It was passed per rectum a few days later, and proved to be a steel ball, such as was used in the bearings of automobiles.

The child's vomiting ceased immediately after the passage of the ball into the stomach, and the further recovery was uneventful.

MALIGNANT STRICTURE OF THE ŒSOPHAGUS.

DR. GREEN presented a married woman, 54 years old, who was admitted to the service of Dr. Abbe in October, 1911. She

was much emaciated, and complained that during the previous six months she had suffered from dysphagia. Examination of the œsophagus showed an obstruction below the level of the bifurcation of the bronchi.

Early in November, Dr. Abbe did a gastrostomy under local anæsthesia, and she was fed by this means. The introduction of a bougie through the mouth showed the presence of a stricture of the œsophagus, 8 mm. in diameter, and situated ten and a half inches from the upper incisor border. After some dilatation of the stricture by means of the string-cutting method, a lead capsule containing 100 mg. of radium was introduced by Dr. Abbe, and left there for six hours. After this, the stricture was dilated once a week by means of bougies. The patient was now able to swallow her food with comfort, and she left the hospital on December 18, much improved. When she returned, some weeks later, the stricture showed a tendency to re-contract. It was again divided by the string-sawing method, and 100 mg. of radium contained in a lead and gold capsule, two mm. thick, was again introduced by Dr. Abbe and left there for eight hours. The stricture was now being dilated about every fortnight. The gastrostomy wound was being allowed to close, as the patient was now taking her food normally and was very comfortable.

FOREIGN BODY IN THE LARYNX.

DR. GREEN presented a child, 21 months old, who was admitted to the hospital on February 23, 1912, with the history that the night before his admission he had inhaled a small clasp-pin. This produced an attack of choking and dyspnœa; then the symptoms became less urgent, and the child breathed like an asthmatic.

By means of the direct vision laryngoscope, the pin was seen with its upper end just above the false cords. It was grasped with long, special forceps, and withdrawn. The clasp-pin was open at the time of its removal. The child was able to leave the hospital on the day following the operation.

DR. ABBE said that while it was common to see a cicatricial stenosis of the œsophagus result from the ingestion of caustics, he could not recall a single instance where stenosis followed an ulceration or injury of the œsophageal mucosa produced by the

introduction of tooth-plates or other foreign bodies into the gullet, even when long detention had produced ulceration.

ILEOCOLIC INTUSSUSCEPTION: REDUCTION AND ANCHORAGE BY MEANS OF APPENDIX.

DR. N. W. GREEN presented an infant, six months old, who was admitted to the hospital in June, 1911, with symptoms of intussusception. Twenty-four hours after the onset of his attack Dr. Green operated upon him and found the ileum and ascending colon intussuscepted into the transverse colon. By gentle massage and traction the intussusception was entirely reduced. The bowel showed no lack of lustre nor were there any adhesions, but it seemed reasonable to infer that the condition might recur if nothing further were done. As the appendix presented itself as a good means of anchorage, he drew this through a stab-wound in the right iliac fossa clear to its base, and sutured it to the peritoneum, also using its mesentery to prevent it from dropping back. It was then placed between two wipes, and irrigation with salt solution was performed through it. This latter procedure was done at the suggestion of Dr. Abbe. The median wound was closed by the layer method. The appendix sloughed off shortly, and both wounds healed without delay. The patient was discharged on the eighteenth day.

A second similar case was that of an infant, four months old, who was admitted in December, 1911, with the symptoms of acute intussusception, and was operated on by him twelve hours after the onset of the symptoms. An ileocolic intussusception was found, and the bowel was reduced by carefully squeezing it with one hand and traction with the other. There was no evidence nor tendency to the formation of adhesions, nor was there any lymph thrown out. Through a stab-wound in the right iliac fossa the appendix was drawn out, and its mesentery and serosa anchored to the peritoneum, the appendix then being placed between two wipes. The median wound was closed, using one suture for the peritoneum, and closing the remaining layers with through-and-through silkworm gut. The appendix sloughed away on the fifth day, and four weeks after the operation the patient was discharged in good condition and with all the wounds healed.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held April 1, 1912.

The Vice-President, DR. JOHN H. GIBBON, in the Chair.

EXCISION OF UPPER END OF HUMERUS FOR FRACTURE-DISLOCATION.

DR. CHARLES F. NASSAU presented a man, aged 36 years, who, on April 25, 1907, fell a distance of 26 feet, striking on his head and left shoulder. He was treated in a hospital, where he was partly unconscious for two weeks. He had a leg injury and lacerations that yielded to treatment perfectly and gave no trouble. He was admitted to the Jefferson Hospital, February 3, 1908. Careful skiagraphic study by Dr. Manges showed a partially unreduced dislocation of the head of the left humerus complicated by a longitudinal fracture through the head and upper part of the shaft, allowing the external rotators to pull the tuberosity posteriorly against the edge of the glenoid cavity. The shoulder-joint was practically ankylosed, and the scapula moved with every effort to use the arm. The muscles of the arm were much atrophied, particularly the deltoid. In order to avoid any further injury to the circumflex nerve and considering the position of the bone fragment, the Kocher posterior incision was resorted to. In this approach to the shoulder-joint no muscle-fibres are paralyzed. The skin incision starts slightly in front of the acromioclavicular joint, runs down over the acromion and spine of the scapula, and then curves away from the median line toward the lateral aspect of the chest. The acromioclavicular joint is exposed; the trapezius muscle is separated from the acromion and the deltoid is separated on the outer side of the acromion only, posterior to its base. The acromion is drilled previous to separating it from the scapula to facilitate replace-

ment by wiring. The acromion and deltoid muscle are now laid outward, thus exposing the joint capsule, the supra- and infraspinatus muscles, circumflex nerve, etc. It was found necessary in this case, after removing the detached fragment, to excise about three inches of the head of humerus in order to obtain absolutely free and unlimited motion in every direction. The arm was mobilized sufficiently to lay it up against the side of head.

At the close of the operation the acromion was wired in place with No. 14 silver wire and the muscles restored with No. 2 20-day chromic catgut. Two small tube drains were used for 48 hours. Healing occurred with primary union throughout, and the stay in the hospital after operation was 16 days.

The patient has now a powerfully developed arm with an almost perfect voluntary range of motion. He owes this to the early use of skilfully given massage and his own cheerful co-operation in active though at first painful movements.

DR. GEORGE P. MÜLLER said that he operated on a similar case two years ago. The patient, a woman of 60 years, was admitted to Dr. Frazier's service in the University Hospital with an old subcoracoid dislocation of the humerus and with stiffness of the shoulder and pain. He attempted, under ether anæsthesia, to loosen up the adhesions, and failing, again tried through an open incision but fractured the neck of the humerus high up. He then removed the fragments and obtained a good functional result. An anterior incision was made and he had some difficulty in getting a good exposure.

DR. JOHN H. GIBBON said that a few months ago he used this same incision for the subperiosteal excision of the head of the humerus in a case of congenital posterior dislocation. The result has been very satisfactory although the child has not obtained as good a result as in the case presented by Dr. Nassau. This condition was supposed to have been a birth palsy and the girl was 14 years old at the time of operation.

GOITRE.

DR. NATHANIEL GINSBURG presented the following patients:

CASE I.—Woman, 41 years of age, who was the mother of the two succeeding cases, all of whom present some form of goitre. She has had a tumor of the right lobe and isthmus of

the thyroid gland for ten years. There is no thyroid intoxication and she is unwilling to have any operative treatment at the present time. The tumor is probably an adenoma.

CASE II.—Girl, 17 years of age, a daughter of the previous patient. She has noticed an enlargement of the neck for the past two years. Her mother and one sister each present hypertrophy of the thyroid gland; and a maternal aunt also has a goitre. She had diphtheria at eight years of age, and since then has been subject to frequent attacks of tonsillitis. At the present time she complains of palpitation and vertigo with considerable headache. She also states that she has occasional spells of depression with crying. The menstrual habit began at 13 years of age and was regular until within the last year. Her pulse is 104; except for some acceleration in the pulse-rate, there are no other symptoms pointing to hyperthyroidism. The swelling of the thyroid gland is bilateral and shows more involvement of the right lobe and isthmus than of the left lobe.

CASE III.—Girl, 11 years of age, the third member of the family, who also presents an enlargement of the thyroid gland. She had diphtheria at 8 years of age and following the attack an enlargement of the thyroid gland occurred. She does not complain of any symptoms and otherwise appears to be perfectly well.

The two latter patients appear to have a simple physiological hypertrophy of the right gland which has the direct relationship to the onset of menstruation.

CASE IV.—Woman, 43 years of age. This patient is one upon whom excision of the left lobe and isthmus of the thyroid gland was performed in conjunction with Dr. L. W. Steinbach. The patient prior to operation presented all the symptoms of extreme hyperthyroidism with the exception of exophthalmus. The pathological diagnosis confirmed the clinical diagnosis and showed evidences of reversion in the epithelial arrangement of the parenchyma of the gland. At the present time, one year following the operation, she presents some enlargement of the right lobe of the thyroid gland with some tremor and a pulse of 98. Dr. Ginsburg requested the opinion of the Society as to whether further operative interference would be justified in this case.

CASE V.—Man, 20 years of age, who presents a symmetrical

hypertrophy of the entire thyroid gland, the duration of which is indefinite. He believes that his neck has markedly grown larger during the past three months. The patient does not present any symptoms referable to hypersecretion of the gland. His neck measures sixteen inches. The veins on the anterior surface of the neck are markedly enlarged, and the goitre appears to be of an extremely vascular type.

The gland is rapidly increasing in size, and operative interference seems to be justifiable for the purpose of preventing symptoms which will later appear, either in the form of thyroid intoxication or the effects of pressure upon the viscera, or adjacent structures in the neck. Dr. Ginsburg desired an expression of opinion on the part of the members of the Academy regarding the extent of operative interference which should be carried out in this case, with particular reference as to the advisability of ligation of the superior thyroid arteries, or excision of part of the gland.

CASE VI.—Girl, 18 years of age, who had an excision of the right lobe and isthmus of the thyroid gland in May, 1911, for symptoms of hyperthyroidism. Improvement was marked following the operation, and except for some huskiness of the voice she is now in good health.

CASE VII.—Girl, 16 years of age, who presents a simple goitre involving the right lobe and isthmus of the thyroid gland which dates back to the onset of her menstrual period 18 months ago. Her neck measures $12\frac{3}{4}$ inches and has increased in size during the past five months. This appears to be a simple physiological hypertrophy of the thyroid gland occurring at the onset of the menstrual habit.

CASE VIII.—Girl, 15 years of age, who presents a simple goitre involving both lobes of the thyroid gland. Her menstruation habit began one year ago, shortly following which there appeared some enlargement of the thyroid gland. She is able to work and feels perfectly well, and there are no indications of hyperthyroidism. This case belongs to the classification of the preceding case of a simple goitre dating from the onset of the menstrual habit.

CASE IX.—Woman, 21 years of age, who was observed in June of 1911 when she consulted the reporter for extreme nervousness and tremors of the hands and feet. She was unable

to remain quiet during the examination, her whole body being in a constant tremulous state. There was some exophthalmus and the pulse-rate was 92. She had noticed the enlargement of the thyroid gland six months previously and believed the swelling was increasing in size. In addition to the above symptoms the vasomotor symptoms were very marked. On November 9, 1911, excision of the right lobe and part of the isthmus was performed with some slight intoxication following operation, which subsided at the end of 48 hours, recovery after this being uneventful. At the present time (April, 1912) improvement is not as marked as he had hoped to have it and there is some suggestion in the mental attitude of the patient of a lack of nervous equilibrium which may not have any direct relationship to thyroid gland intoxication.

DR. JOHN H. JOPSON said that he had had one case of recurrence of exophthalmic symptoms due to hypertrophy of the remaining lobe of the thyroid. A second operation, viz., resection, was required, and resulted in a permanent cure.

DR. GEORGE G. ROSS said that there was a case similar to the one shown by Dr. Ginsburg and to that reported by Dr. Jopson operated on recently by Dr. John B. Deaver, at the German Hospital. The left lobe was removed for exophthalmic goitre three years ago. The patient remained perfectly well for two years, then she was in a trolley accident, was not severely injured, but was frightened, and six months after had an enlargement of the right lobe with all the classical symptoms of exophthalmic goitre. She was watched carefully for ten days, the method of preliminary anaesthetization daily was carried out, and her pulse remained at 160. For the first 48 hours after operation the pulse remained about 160, but for the last 48 hours it has gotten down to 120-136. She is making a good recovery. In this case recurrence was brought on by fright rather than by injury.

DR. MORRIS B. MILLER remarked that fortunately Philadelphia is not in the goitre belt and its surgeons do not see these cases in great numbers; in consequence, compared with men in the West and in Switzerland, no man's experience here is very large. Nevertheless it is our duty as surgeons everywhere to point out to our medical confreres the importance of recognizing hyperthyroidism early. The time to consider goitre cases is

before they get into serious trouble. It is well known that physiological goitre occurs in women at puberty and sometimes at recurring pregnancies, and the symptoms are definitely recognized, but in these cases there is always a little danger. However, there is a point when the recognition of hyperthyroidism should be noticed before it reaches an extreme form. Many cases are referred to the surgeon uncomfortably late, and in these cases if early rest or early operation were undertaken a good deal of trouble would be avoided.

DR. GEORGE P. MÜLLER said that the treatment of these simple goitres should vary with the particular case. It is common to confuse the so-called unilateral or nodular goitre with the diffuse parenchymatous process. If one bears in mind a simple scheme of the pathology of this affection, confusion may be avoided. If we draw a circle and make eight or twelve dots representing the solid epithelial masses of the fetal thyroid, which after birth develop and produce a typical acinus in the thyroid lined with low cuboidal epithelium and containing colloid, the dots become circles. At the occurrence of menstruation and at pregnancy, the thyroid often enlarges uniformly over the neck, and it enlarges because each acinus is enlarged because of interference with iodine metabolism. This is an ordinary hypertrophy. These patients, if properly treated medically, often recover completely. In other cases, however, something happens to the absorption of the colloid material and we have a permanent enlargement, unchanging in size, due to dilated acini—multiple retention cysts as it were. These physiological hypertrophies do not require operation unless they cause distinct pressure, an objectionable disfigurement, or because of the possibility of carcinomatous degeneration or because of the onset of exophthalmic symptoms. In another class of cases, development fails in one area of acini or becomes abnormal, so when the patient grows older we have again the ordinary acini but in one lobe we have a proliferation of the acini and a tumor forms, gradually increasing in size until we have a unilateral nodular goitre surrounded by normal thyroid, often compressed to a mere shell. These are adenomas, potential causes for exophthalmic goitre or for malignant change, and should be removed, no matter at what age they occur. Such a patient was operated on at the University Hospital a month or so ago by Dr. Martin

for exophthalmic symptoms, and in two weeks most of her symptoms had disappeared and she is now making a good recovery.

With regard to the boy shown by Dr. Ginsburg, his opinion was that if the growth is only of three months' duration, it should be treated conservatively, say for a year by medical means, but it will ultimately come to operation. He did not see how ligation of the superior thyroid could be of any value in this case.

ANTERIOR LUXATION OF THE TENDONS OF THE PERONEUS LONGUS AND BREVIS.

DR. MORRIS BOOTH MILLER presented a man, aged 28, who was seen on April 19, 1908. About three months previously, while riding on the platform of a trolley car, he was suddenly thrown to the street as the result of a collision of the car with a wagon. As he was falling he managed to grasp a hand rail, and he made violent and finally successful efforts to get upon his feet. Both ankles were badly sprained and he was under the impression that the right one was struck by the wagon. He was not able to walk, was taken to a nearby hospital in the patrol wagon and later to his home. He was confined to the house for six weeks and did not return to work until two weeks later.

When examined the left ankle was about well of what had been apparently a sprain. As to the right side he complained of being lame to a slight extent and that he was apt to twist the ankle without any decided cause, often while walking on a level surface. If he was obliged to stand for a long time without rest he felt that it was less secure and strong, and as much of his work was on ladders he felt bothered and handicapped by a sense of insecurity.

He was a tall young man of healthy appearance and fair general musculature. When his feet and legs were bared it was noted that he had pes planus present on both sides and to about the same degree. This he stated had existed as long as he could remember, never gave him any trouble, and was not affected by the accident. In walking he favored very slightly the right side and seemed a trifle unsteady in gait, but he had no definite lameness. He had naturally rather broad ankles. On the left side the joint was free, the range normal. On the right

side the condition was different. A swelling was present over and below the external malleolus, which was due in part to slight thickening of the external lateral ligament but in the main to the fact that he had sustained an unusual injury, namely, that the tendons of the peroneus longus and brevis had been torn out of their common sheath and were over-riding the malleolus instead of lying behind it. Both tendons could be made out in their superficial location and were absent from their usual site. They were not appreciably thickened and were not tender. Their mobility was somewhat decreased. No atrophy of either muscle could be made out. The tendons could not be pressed back by pressure.

It will be recalled that the peroneus longus tendon angulates twice, first in the groove common to it and to the peroneus brevis behind the external malleolus, and second, on the plantar surface of the cuboid beneath the long calcaneocuboid ligament, where it turns again toward its insertion on the outer side of the base of the first metatarsal. The course of the peroneus brevis is more direct and only the first bend exists. As the result of the displacement the angulation behind the malleolus was practically obliterated. The cause undoubtedly was violent muscular effort to overcome inward twist of the ankle. The effect on function was not as serious as might be expected. It served to prevent him rising far on his toes, it had a tendency to render his gait a little unsteady, and, of course, his balance was not good when he stood on that foot, but the actual disability was not very material even for a working man. He was advised to return for operation providing the displacement continued to affect him after a few more weeks of use. As he has not been seen since it is presumed that satisfactory compensation has occurred.

PRIMARY TUBERCULOSIS OF THE TENDONS OF THE PERONEUS LONGUS AND BREVIS.

DR. MILLER reported the case of a twelve-year-old boy who was referred to him by Dr. J. S. Watson early in April, 1911. The story given by the patient and his mother was to the effect that in June, 1910, he had twisted or turned his right ankle while at play, and in consequence he had developed some pain, a tendency to drag the foot, and the ankle was weak and apt to turn.

Slight swelling had been noticed over the outer ankle quite early, and this had slowly increased. There was no discoloration at any time. Pain and swelling had been constant phenomena since the first; both were made worse by walking or by the accidental ankle twists to which he was subject. No member of his immediate family had ever had tuberculosis.

He was a well-developed lad for his age and in good physical state except for the local condition. There was a tendency to limp, scarcely noticeable when he walked slowly but perfectly clear when he moved briskly. The right leg was perceptibly smaller than the left and the calf musculature was distinctly less firm to the touch. No atrophy of any muscle or muscle group could be made out. From a point posterior to the external malleolus downward and below the malleolus there was well-marked swelling over an area corresponding to the tendons of the peroneus longus and brevis. The maximum fulness was on the outer side of the foot, approximately at the location where the common sheath divides, and it gradually tapered upward until it merged into normal structures. It was not doughy nor oedematous but was rather elastic. No crepitation could be felt. It was not tender to direct pressure, and pain was not occasioned by the simple movements of the joint, but when the foot was strongly inverted he complained of discomfort. He could easily balance himself on his left foot but not at all on the right.

He was admitted to the Polyclinic Hospital and was operated on, April 14, 1911. A three-inch incision down to and into the tendon sheath exposed a mass of degenerated tissue, some portions of which were filled with riziform bodies and other portions showed tuberculous granulations. The tendon sheath was much altered and thickened, but the tendons themselves were not affected and had their normal smooth surface. There was little if any caseation. The diseased tissue was removed by the curette and scissors, and so thoroughly was this done that for a space of over two inches none of the sheath wall was left. In tracing down the peroneus brevis tendon into its separate sheath another adjacent mass was opened up and similarly removed. The wound was partially closed with sutures, the affected areas packed with iodoform gauze, a dry sterile gauze dressing was applied, and the ankle was immobilized with plaster of Paris. Patient was discharged from the hospital in two

weeks. Healing was tedious and it was several weeks before the wound finally closed. During this time the ankle was kept at rest by plaster and silicate dressings, and subsequently for nearly three months he wore a steel brace attached to the shoe to prevent lateral movements of the foot. He made a perfect recovery with no lameness, no limitation of motion, and no local evidences of disease.

The pathological report submitted by Dr. James A. Kelly stated that the microscopical examination showed the tissue to consist of œdematous granulation tissue containing tubercles, giant-cells, fibroblasts, and areas of necrosis. The diagnosis subjoined was tuberculous tenosynovitis.

TUBERCULOUS TENDOVAGINITIS.

DR. GEORGE P. MÜLLER said that tuberculous tendovaginitis would seem to be a rare condition judging from the scarce mention made of it in the periodical literature. It may occur in persons who have no other tuberculous lesions, and appears as a serous or serofibrinous effusion or a granular proliferation in the tendon sheaths. These give rise to an increasing swelling, sometimes tender, sometimes doughy, and often with a characteristic grating sensation due to the formation of rice bodies and their movement to and fro beneath the annular ligament. In the cases here reported the swelling was globular, not elongated, and there was no grating whatever in either case. In the treatment, the endeavor was made to dissect out the sheath and remove all of the disease, sparing the tendon if possible. In neither of these cases could this have been done, owing to the involvement of the carpal bones and the extensive involvement of the soft tissues. In none of the text-books is mention made of amputation being the final resort.

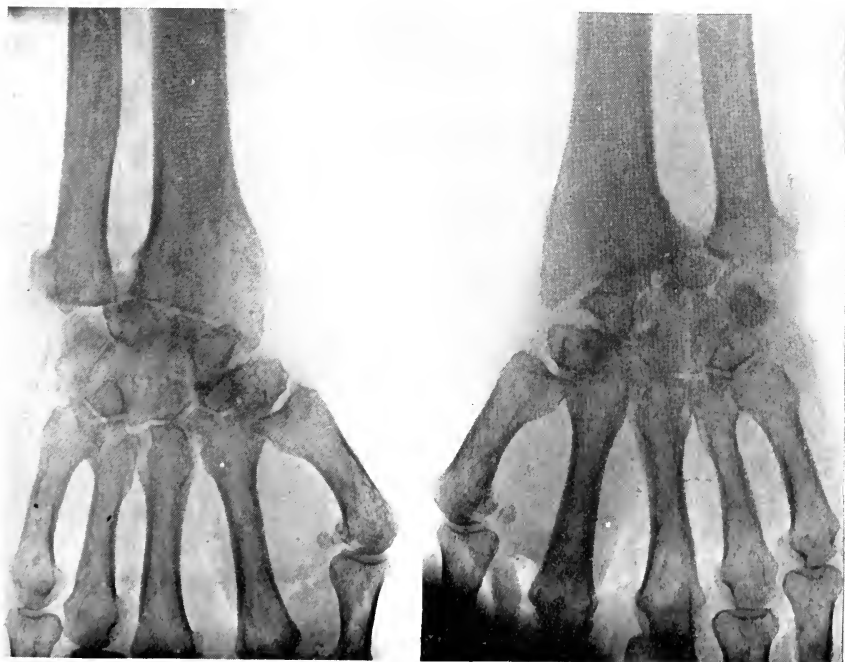
CASE I.—Woman, age 48 years, domestic, a stout florid person with no disturbance in the general health, no pulmonary lesions, and no family history bearing upon the disease. About two years ago the left wrist began to increase in size with some interference to the motion of the fingers. It was not inflammatory nor painful and was only slightly tender. Examination revealed two swellings, one over the radial aspect and the other over the ulnar aspect of the wrist-joint, the entire joint also being increased in size, which were doughy, soft and slightly

FIG. 1.



Tuberculous tendovaginitis. The wrists have decreased about half in size since using tuberculin. Pain is entirely absent. It was constant.

FIG. 2.



Conditions of bones in case of tendovaginitis shown in Fig. 1.

tender, without adherence nor reddening of the skin. Movement of the wrist was unduly free, but the patient could not completely flex the fingers. An X-ray examination revealed marked necrosis of all the carpal bones, of the ends of the radius and ulna, and of the bases of the metacarpals. The bones seemed to have dissolved and to have run together.

It was thought best to amputate through the middle of the forearm. The flaps healed by first intention, and one month later the patient was entirely well.

CASE II.—Man, aged 62 years. Three or four years ago after catching cold he suffered from cough but without expectoration. This left a residual sense of soreness beneath the sternum which has persisted up to the present time. In the early part of 1911 a swelling of the right wrist was noted, associated with stinging pain. During the fall the left wrist also became involved. There were no inflammatory signs and no sinuses. Health was otherwise good. Some dyspnoea for the last six months, but no cough and no loss of weight. At present time, complains bitterly of the soreness beneath the sternum, which he states often keeps him awake at night. He has no complaint whatever in regard to the wrists. He states that when he moves there is a grating sensation beneath the sternum, and upon examination of this place a prominence is detected at the junction of the manubrium and gladiolus. There is no tenderness nor redness. At the right apex the note is high pitched and there is bronchial breathing, but there are no râles. Heart somewhat enlarged and pushed to the left with weak and slow sounds. The X-ray revealed the existence of a mass, possibly tubercular, in the mediastinum (Pancoast). No other findings.

Patient remained in the hospital for two weeks, during which time the temperature range was slightly subnormal; pulse 56 to 72; respiration about 20. He was given tuberculin and reacted moderately. An X-ray of his wrists revealed marked softening and destruction of the carpal bones with evidence of relaxation through destruction of ligaments, as the semilunar bone was dislocated downward between the radius and ulna. Patient sent back to his home and two courses of *tuberculinum purum* were given, at the end of which his doctor reports that he is much improved.

DR. JOHN H. JOPSON referred to two cases of tuberculous

tenosynovitis upon which he had operated. One patient was an old Italian who first had an involvement of the sheath of the flexor tendon of the third finger. A fairly thorough operation was done in this case but the disease progressed upward and involved the tendons of his wrist, necessitating a second operation, which was much more extensive. The wound healed and although he still complained of pain, the result was for a time satisfactory. The other case was that of a young woman who presented a swelling on the extensor tendons of the left wrist about level of the styloid process of the ulna, practically a case of compound ganglion. These cases of compound ganglion are nearly always instances of tuberculous tenosynovitis. An exception to this was the case of a well-known surgeon of Philadelphia, long since dead, who had a compound ganglion of the hand for many years. A diagnosis of tuberculosis was not made at the time of operation upon this young woman, but oedematous granulation tissue was dissected, but with considerable difficulty, owing to the extent to which it involved the extensor tendons. The report came back from the pathologist that the condition was one of tuberculosis. A year or two later the patient developed pulmonary tuberculosis. The speaker remembered another case under the care of Dr. Edward Martin in which amputation was the last resort.

DR. JOHN H. GIBBON said that he operated on a patient a year ago for tuberculous infection of the extensor tendon sheaths of the ulnar side of the wrist. He had a recurrence but in that case they obtained a most satisfactory result and controlled the condition very well by the X-ray. The man was greatly relieved of his pain and went back to his work, that of a painter. The X-ray treatment was continued for some time. He was also given iodides. The speaker said he had lost track of the case and whether there was an ultimate recovery he did not know.

TORSION OF THE OMENTUM.

DR. GEORGE P. MÜLLER reported the case of a woman aged 42 years, who had had a right inguinal hernia for 25 years. She did not wear a truss for it. Two years ago, a mass appeared in the inguinal region, hard but not tender. At the same time she began to complain of gastric symptoms, distress, and fulness after eating, and vomiting in the mornings. Four weeks

ago she began to suffer from pain in the right inguinal region gradually increasing in severity and spreading to the right iliac fossa. Twenty-four hours before admission to the Chester County Hospital, the pain became acute and was accompanied by marked nausea and vomiting.

On examination, he detected a mass in the right iliac fossa, very tender to palpation and quite hard. Temperature was 100°; pulse 90.

Upon opening the abdomen, November 17, 1910, bloody fluid escaped and a mass of omentum presented itself, purplish in color. There was no pus but the adjacent intestines were red and infected. The mass was attached below by a narrow pedicle to the internal ring, and above, near the colon, was twisted five times into a cord. The intervening portion, as large as a coconut, was the strangulated omentum. It was removed. The appendix was also removed. The hernial sac was opened and found also to contain omentum adherent to the sac. The sac and contents were removed and a Bassini herniorrhaphy done.

On April 1, 1912, patient states that she is perfectly well.

In connection with this Dr. Müller said that the first mention of torsion of the omentum seems to be by Oberst, in 1882, but it is only during the past 15 years that the reports of cases have become more frequent. In 1900, Wiener (*ANNALS OF SURGERY*, 1900, vol. xxxii, 648) wrote a statistical paper and reported a few cases. In 1905, Corner and Pinches (*A. J. M. S.*, 1905, vol. cxxxv, 314) were able to collect 54 cases from the literature. Finsterer in 1910 (*Beit. z. klin. Chir.*, Bd. 68, Heft. 2, p. 521) reported that the number of cases had increased to 72. In 1911, Hedley (*Brit. Med. Jour.*, Nov. 11, 1911, p. 1246) found reference to 93 cases of which he obtained details of 73.

"The term, torsion of the omentum, should include only those cases in which twisting of the omentum on itself has caused a sufficient obstruction of the circulation to produce evidence of strangulation" (Richardson). A study of the reported cases suggests that torsion may be divided into the following (Payr):

1. Torsion without co-existing hernia: (a) Simple cases involving the omentum only; (b) complicated cases involving other adherent abdominal organs.

2. Torsion with pre-existing hernia: (a) Intra-abdominal torsion without involvement of the hernia; (b) intra-abdominal

torsion with involvement of the hernia (strangulation, inflammation); (c) omental torsion within the hernial sac only; (d) complicated cases: (1) both intra-abdominal and hernial twisting; (2) either intra-hernial or intra-abdominal torsion associated with a retrograde incarceration.

Another classification is that suggested by Richardson into: (a) Intrahernial omental torsion; (b) Intra-abdominal omental torsion; (c) Intrahernial and intra-abdominal omental torsion.

In the first group, he includes those cases in which the point of torsion lies at least in part within the sac, and the mass of strangulated omentum lies entirely within the sac. These cases are distinguished from strangulated epiplocele by the presence of a twisted pedicle and by the presence of constriction at the hernial ring.

In the second group, the point of torsion lies within the abdominal cavity or partly within the abdomen and partly within the sac of a hernia but not constricted at the hernial ring. This class contains by far the largest number of the reported cases.

In the third class, there exist two points of torsion,—one within the abdomen and the other within the sac of a hernia; there will thus be formed one or two strangulated masses of omentum according to the location of the distal point of torsion.

Etiology and Mechanism.—The torsion may occur about one point, about two separate points, or may be complicated in its mechanism as when the strangulation is produced by the twisting of separate shreds of omentum about each other or of one shred about the main mass.

The etiology of torsion of the omentum is not particularly clear. Omental adhesions either at a single point or at many points are common in the experience of every surgeon, and the adhesion of the omentum to the hernial sac is also of common occurrence, and yet torsion of the omentum is peculiarly uncommon.

Richardson states that the formation of a mass of matted omentum at its free extremity or the formation of a second fixed point of adhesion of the free end to some other structure is necessary for its production. Griffith (*A. J. M. S.*, 1910, vol. cxxxix) believes that it is necessary for the great omentum to be

attached primarily to the peritoneum over the right kidney, thus forming a point of adhesion and torsion, while Lockett (*J. A. M. A.*, 1910, liv, 1364) believes that enlarged full veins are a factor. It is probable that some irregular and increased peristaltic action or some unusual effort of the abdominal muscles acting on an already enlarged or adherent omentum is the principal immediate cause of torsion.

The symptoms frequently simulate other acute abdominal conditions such as volvulus and appendicitis. There is a sudden onset of pain, nausea or vomiting, constipation, tenderness, rigidity etc. The pulse and temperature do not rise as rapidly as in acute appendicitis and the area of tenderness is wider. It is significant if there are signs of acute trouble in a co-existing hernia, but all of the above symptoms could be simulated by a strangulated hernia alone. In the cases reported the diagnosis was generally not made before opening the abdomen. Whenever it was made, however, it was based on the finding of a tender mass in the abdomen, or there was some connection with a hernia. Even though the previous history disclosed the existence of gastric symptoms, due to dragging on the stomach by a chronically inflamed omentum, these might be similar to those produced by chronic gall-bladder or appendiceal trouble.

Treatment.—The only treatment is by operation. The prognosis in the cases operated upon is about 14 per cent., a death rate entirely too high for the existing pathology.

DR. WALTER G. ELMER remarked that acute torsion of an ovarian cyst might perfectly simulate torsion of the omentum and that it might be impossible, under certain circumstances, to differentiate them.

BEVAN'S OPERATION FOR UNDESCENDED TESTICLE.

DR. JOHN H. JOPSON read a paper with the above title.

DR. B. A. THOMAS said that his distinct understanding of the Bevan operation is that the most important feature is the severance of the spermatic vessels. That certainly is the only theoretical objection to the operation for undescended testicle, namely that severance of these vessels to some extent at least should and does interfere with the further development of an already

atrophied testicle. If the spermatic vessels can be conserved as they may be by doing the Davison operation, it seems that the ideal operation may be attempted in these cases. Davison's idea is to straighten the spermatic vessels, inasmuch as they are the restraining influence in the attempt to elongate the cord, in order to place the testicle comfortably in the scrotum. The inguinal canal is exposed, the vas and its vessels isolated, the hernia, if present, treated, and the tunica vaginalis sutured to enclose the testicle as in the common performance of the operation. The deep epigastric artery is then doubly ligated, and the transversalis fascia split from the internal to the external abdominal ring. The spermatic vessels are then freed by gauze dissection from the preperitoneal fat and peritoneum much as a rubber band is made to slip over the end of an egg. Both the spermatic vessels and vas are then brought through the lower angle of the transversalis wound at a point behind the external ring. Thus it will be seen that the gain in length of the spermatic vessels for the purpose of elongation is the difference between the hypotenuse—the new line of the vessels—and the sum of the other two legs—the former line—of a right-angle triangle. After securing the testicle in the scrotum, the transversalis fascia and the other layers of the wound are closed.

DR. WILLIAM L. RODMAN remarked that Dr. Jopson is undoubtedly right in the statement that many former authors overrated the danger of undescended testes subsequently becoming carcinomatous. Any imperfect gland is somewhat more prone to malignancy, but this tendency is not so great as to make it imperative to sacrifice a testicle. Practically all these cases are accompanied by hernia. He did not think he had ever seen a case of undescended testis where he looked for hernia that he did not find it.

In one or two cases where he had attempted to carry out the operation as laid down by Bevan he had failed to make the cord sufficiently long to bring the testis down and keep it in the bottom of the scrotum, but where this operation fails all others will. It may really be unnecessary to suture the testicle in the scrotum when the cord is sufficiently long, yet it should be done as a precautionary measure. It is conceivable that in the process of healing there may be adhesions which might again draw the testicle into the canal.

DR. HENRY R. WHARTON said that he had never performed Bevan's operation for undescended testicle, but had seen good results following it, and shall employ it. He did not have any difficulty in getting the testis into the scrotum, but had never been able to get the organ well down in the scrotum.

With regard to replacing the undescended testicle in the abdomen if the cord is found too short to permit the organ to be placed in the scrotum, he would not advise it. He remembered one case of gangrene of an undescended testicle associated with appendicitis, and such a possibility would argue against its replacement.

DR. JOHN H. GIBBON said that he had done Bevan's operation whenever he could not easily replace the testicle, and he had never hesitated to cut the veins in liberating the vas and its individual vessels from the surrounding structures. It mobilizes the testicle to a remarkable degree. The removal of the testicle in these cases he could never understand. If a testicle is going to become sarcomatous it is going to become so because it is arrested in its development, and whether in the abdomen, canal, or scrotum it will make no difference. If it has that disposition it will have it always. As for taking it out he did not think he had ever done it, and did not think it justifiable.

Regarding traction, he was convinced that in young babies with undescended testes these can be brought by proper manipulation on the part of the mother or nurse into the scrotum. This has been done. If one can correct a club-foot or lessen a cleft in a palate by manipulation it stands to reason that one should be able to elongate the attachments of a testicle. If the testicle can be brought out of the external ring it can be brought into the scrotum.

Regarding suturing the testicle in the scrotum he had not done it in recent cases. A good purse-string as Bevan suggests will hold the testicle down. He had not always been able to get the testicle into the bottom of the scrotum, but always pretty low down. The results with the Bevan operation have been most satisfactory.

CORRESPONDENCE.

BILIARY CALCULI OF LARGE SIZE REMOVED FROM COMMON DUCT.

EDITOR ANNALS OF SURGERY:

IN vol. xlviii, No. 5, p. 676, ANNALS OF SURGERY, November, 1908, Dr. Willard Bartlett, St. Louis, reports a very interesting case of large choledochus stone removed by him January 2, 1906. The writer has recently had a similar case which in many respects parallels the above report both in history and size, the calculi being slightly less in weight. There may have been larger common-duct stones removed at operation than here reported, but like Dr. Bartlett I have been unable to find any record of them. In reading the report of Dr. Bartlett's case I was struck by the fact that his patient was "proprietor of coal mines" (it would be interesting to know whether he was ever actively engaged as a miner), and as the occupation of the patient here described was that of coal miner, it at first thought appears more than a coincidence that the possessors of these large calculi should have been engaged in the same pursuit.

Another point of similarity of the two cases is the comparatively early ages at which these stones occurred, Dr. Bartlett's patient being 45 years, the present subject only 32 years. Another resemblance between these two cases was the fact that contrary to the law of Courvoisier the gall-bladder in both instances was markedly distended. The thought has suggested itself to the writer that these large stones may have arisen from traumatism to the bile-ducts brought about through pressure against the "pit" of the stomach by the miner's auger once in such common use. In the employment of this instrument the operator is often compelled to lie for hours upon one side, using the abdominal muscles in the region of the epigastrium to force the bit into the coal. The following is the brief history of the present case:

Henry H., age 32, occupation coal miner, referred to me January 11, 1912, by Dr. W. L. Gambill, Van Lear Coal Co., with diagnosis "gall-stones." Past history negative up to about eight or nine years ago, when patient began to suffer with attacks of epigastric pain and chronic indigestion. Two or three times yearly these attacks became so violent as to totally incapacitate him for work for a week or ten days, morphine hypodermically always being required to bring relief to his intense suffering. Between these severe attacks he was able to follow his occupation; but was never entirely free from pain and gastric distress; lately he has lost weight and strength rapidly. Appetite has been good, and bowels have acted only when purgative medicines were taken, the stools at times being light in color, at other times dark brown.

Status Præsens.—Man of average height, spare form, and much emaciated; skin of whole body dark, dirty brown (walnut juice stain); eyes deeply sunken with large margin of each sclera visible; face haggard and seamed from long suffering. Present attack began December 21, 1911, and has continued with unabated violence up to present time; pulse 102 per minute, soft and compressible; temperature 98.4° F.; slight epistaxis; violent hiccough for two or three days past; urine heavily bile stained, otherwise normal to usual tests. Chest organs negative; abdomen markedly distended, but more particularly in the epigastric and right hypochondriac regions. Right upper rectus rigid, with acute tenderness in the region of the gall-bladder; right flank bulging and dull to percussion.

Operation January 13, 1912, King's Daughter's Hospital; chloroform-ether anæsthesia. Abdomen opened over gall-bladder through vertical rectus incision, later enlarged by oblique incision along costal border up to middle line. Numerous dense adhesions present, separation of which gave exit to a large quantity of serous, bile-stained fluid which at first gave the impression that the gall-bladder had ruptured. Further search soon disclosed that the fluid came from a localized peritonitis surrounding the gall-bladder and that the latter was intact although very much distended and inflamed.

Incision of the gall-bladder revealed the presence of several hundred small black calculi and 60 to 90 c.c. bloody mucopurulent fluid. Owing to the presence of numerous and dense adhesions, search for the common duct was rendered very difficult.

In the usual position for the common duct we came upon a structure that at first caused us no little perplexity. It was not easy to say what anatomical structure lay before us, owing to the large size of the common duct, which this structure later proved to be. After careful palpation, calculi could be felt through its thickening walls, and it was not until then that we felt safe in venturing an incision. An incision $1\frac{1}{2}$ inches long was made along the anterolateral border of the supposed duct when the stones came at once into view.

In making this incision an adventitious branch of the hepatic artery (present in 30 per cent. of cases—Treves) was severed, and caused considerable annoyance before it was finally secured. After exploration of the duct it was found to be literally filled with the large calculi shown in the accompanying photograph (Fig. 1). The calculus marked "2" lay in the lower end of the duct with the small end projecting into the duodenal papilla; as can be well seen in the cut this small end was broken off in extracting the larger stone. Calculus marked "1" lay at the junction of the cystic and hepatic ducts, and the photograph shows well the "forked" extremities that extended into these ducts. The other calculi shown were packed in between "1" and "2" almost as firmly as if they had been moulded *in situ*. Altogether ten calculi weighing 840 grains Troy (3ii. less than 3ii.) were removed from the common duct, which had become dilated to the diameter of the duodenum or ileum. The largest stone measured $1\frac{15}{16}$ in. x $1\frac{1}{2}$ in.; the next in size $1\frac{1}{2}$ x $1\frac{3}{16}$ in. In physical characters the calculi were soft and friable, very light in weight as compared to size, of chrome yellow on the inside and coated with black on the exterior; the structure appeared homogeneous throughout.

The patient after operation was apparently progressing favorably toward recovery, when suddenly on the evening of the fifteenth day he developed coma and died within an hour.

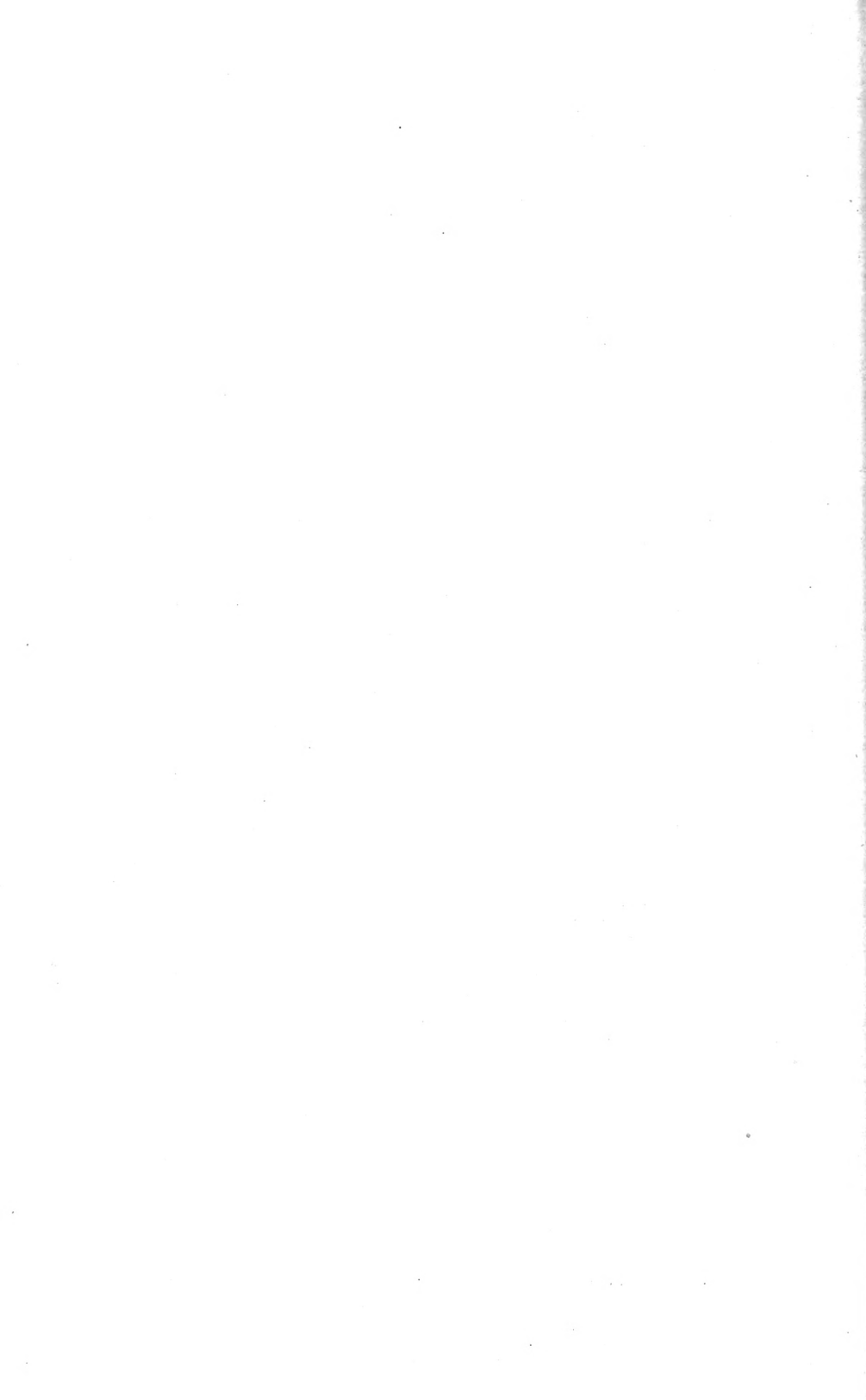
I was permitted the opportunity of making some few post-mortem observations that may help to make this case report more complete.

Post-Mortem Notes.—Abdominal incision, except where drainage was maintained, firmly united. Separation of the lips of the wound showed the gall-bladder firmly united to the abdominal peritoneum in the upper angle of the incision; it was nearly

FIG. 1.



Calculi removed from common bile-duct.



of normal size, healthy looking, and the cystic duct patulous. Liver very much enlarged, of dark slaty color and of firm rubbery consistence; common duct was about same size as at time of operation, and freely open into the duodenum. The index-finger passed up the common duct, readily entered the hepatic branch into the liver substance, the latter imparting to the finger the sensation of being surrounded by a firm elastic ring. The head of the pancreas showed well-marked enlargement and fibrous condensation; spleen about one and a third times larger than normal and of much firmer consistence.

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A NOTE ON THE MISTAKE OF ADOPTING THE IN-
CLINED OR FOWLER POSITION AFTER THE
OPERATION OF GASTROJUNOSTOMY.

EDITOR ANNALS OF SURGERY:

When it was the custom to make the communication between the stomach and jejunum at what was considered the most dependent part of the former, there was some reason for raising the patient's body by placing 18-inch blocks under the legs of the upper part of the bed. The assumption was that in this position the contents of the stomach would more readily gravitate or drain into the intestine, and the contents of the intestine less readily pass into the stomach (vicious circle).

The modern practice, however, of making the communication between the stomach and bowel as near to the pylorus as possible, offers no like reason for adopting this position. As a matter of fact the position becomes the worst that could well be chosen; for the more the upper part of the body is elevated the more sharply is the part of the bowel distal to the anastomosis made to bend downward. This acute flexion tends not only to obstruct the outward flow of the contents of the stomach into the intestine, but it serves to direct the contents of the bowel (bile and pancreatic juice) proximal to the artificial opening, into the stomach. In time, doubtlessly, the result of the gradual, dragging effect of the attached bowel is to make the opening the most dependent part of the stomach; and so the evils liable to exist at first are considerably mitigated and often entirely removed later.

It will be remembered by all who practise the "no-loop" method, that the required part of the jejunum—that just beyond the duodenojejunal bend—is always "fished" up from its normal anatomical position on the left side of the spine. Hence in bringing up the loop and fixing it to the stomach, the distal limb has a natural tendency to return to the left side, that is, to the region from which it was withdrawn.

It follows, therefore, that if we want to minimize, as much as possible, the cause of an acute kink at the distal end of our attachment, we must make the patient lie flat on the back or on the right side.

I have now, for some time, adopted these positions for all my patients upon whom the "no-loop" method of posterior gastrojejunostomy has been performed—that is, when the fistula bimucosa has been made to the right of the middle line, or as close to the pylorus as possible. It seems to answer well.

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BOOK REVIEWS

INFECTIONS OF THE HAND. By ALLEN B. KANAVEL, M.D.,
Chicago. Lea and Febiger, 1912.

This book deals with the pathology and the treatment of acute and chronic suppurative processes in the fingers, hand, and forearm. It is a 447 page octavo volume with 133 illustrations. While much has been published in current periodicals upon these infections, this work enters a new field of the text book sphere. There is need of such a book.

It deals with a class of diseases which the surgeon knows to be serious and much mistreated. The hand is the most exposed to injury of any part of the body; slight infections often go on to destroy its usefulness, or to cause death. The unfortunate fact is that the infections which so commonly end in calamity are usually curable in their early stages.

The first part of the book deals with the minor localized infections. The second part takes up the infections involving the tendon sheaths, fascial spaces, and lymphatics. A chapter on the general principles of treatment embraces much that applies to all of these conditions, and can be read with profit by all who have to do with these infections.

The early treatment, the author shows, should have for its purpose the walling off of the infection or its removal by phagocytic action. By this latter expression the author undoubtedly means not only phagocytosis but the complex of biochemical phenomena that accompanies it. Rest is the first essential of treatment. Perhaps surgeons pay too little attention to it. Passive hyperæmia, the author has found of value in the following three conditions: (1) in those conditions in which it is desired to prevent the rapid absorption of toxins into the circulating blood, as in acute lymphangitis, or immediately after incision of virulent abscesses where constriction will reverse the lymph stream and cause the toxins to be carried toward the wound; (2) in cases which have become semichronic with a low grade of infection; (3) in cases of localized abscess, which do not drain freely, the suction cup is of especial value.

Outside of these conditions the therapy advocated by Bier is looked upon as a possible adjuvant but not as the primary

factor. Early in the course of the infection, if the process is suspected to be virulent, hyperæmia by the rubber bandage may be employed. Suction cups in localized infections are highly recommended.

Hot moist dressings are advocated most strongly. A saturated solution of boric acid, sterilized by boiling, is used. Gauze soaked with this solution is applied to the hand and forearm and covered with some impervious protective and cotton. This should be continued only until the disease is under control.

The author advises against incisions which do not drain anything. In general, the rule is laid down that incisions in lymphatic infections should be made as a last resort or because of secondary complications; tenosynovitis should be treated by drainage as soon as the diagnosis is made; and abscesses of the fascial spaces are never so urgent as to demand operation before a positive diagnosis is made. An Esmarch bandage should be used to prevent bleeding and absorption. It should be removed gradually through the course of twenty-four hours. Nitrous oxide anæsthesia is recommended for all cases.

The material used for drainage is not important, the essential thing being that an incision is made at the right place and of adequate size. Bacterial vaccines and sera are regarded as being of no great value in these cases, but abundance of water and the use of peptonized foods to take up the toxins is advocated.

Admirable drawings show the communications of the bursæ and tendon sheaths. Sappey's beautiful illustrations of the lymphatics are reproduced. Case reports illustrate the various infections. Some of these show the inefficacy of vaccine treatment. General hygiene is shown to be of much importance. Out-door air is demonstrated to be of great value. The treatment of atrophy and contractures resulting from infections is not overlooked.

This is a valuable book. It deals with a subject which has lagged behind in the progress that has characterized other branches of surgery.

J. P. WARBASSE.

A TREATISE ON TUMORS. By ARTHUR E. HERTZLER, M.D., PH.D. Lea and Febiger, 1912.

This is a book of 725 pages with 546 illustrations. The author has been successively a teacher of histology, pathology, experimental surgery, and practical surgery. This book is

written from the clinical rather than from the laboratory standpoint, with the object of giving the practitioner aid in identification and treatment of tumors. It does not touch the field of experimental research, but keeps closely to its aim.

Our English surgical literature has long been in need of such a work, in view of the increasing importance of this subject. It has been stated that nearly one-fourth of all surgical literature deals with tumors.

The book is divided in three parts. The first deals with the general biology of tumors, the second with the special pathology of tumors, and the third with the regional consideration of tumors.

The first part is brief. The second part takes up each variety of tumor, and deals with it separately. A general conception of the tumor is first given. This is followed by a description of its physical characters, microscopic appearance, the relation of the cells and stroma, secondary changes, the constitutional effects of the tumor, the causes of death, its method of growth and dissemination, types of the disease, diagnosis (clinical, microscopic), and treatment.

The regional consideration of tumors constitutes the largest part of the book. In the treatment of carcinoma of the breast, the author conforms to the accepted methods except that he does not regard removal of the pectoralis muscle as a necessary routine step. The method advised by him is essentially the operation first described by Willy Meyer. Twenty-five per cent. of cures, he calculates, follow operation.

The radical measures necessary for the cure of tumors are advised. The early diagnosis of carcinoma of the lip, which is so loudly demanded, the author says often comes to nothing, because it is not followed by an operation that is sufficiently radical. It does not suffice to make simply an early diagnosis; thorough dissection of the lymphatics of the neck should follow.

Attention is called to the fact that carcinomas of vastly different clinical characters occur on the face closely together. The fact that the superficial epithelioma of the skin of the face is so slow growing, and so slowly inclined to lymphatic involvement, is responsible for deceiving the surgeon with the idea that epithelioma of the lip may be temporized with in the same way. This delusion is often strengthened, the author shows, by an apparent cure of the primary disease of the lip, only to be followed by glandular metastases in the neck.

The favorable statistics in operations for carcinoma of the uterus, the author believes, are partly due to the inclusion of conditions which are not malignant. The author does not agree with Young that 10 per cent. of all enlarged prostates are carcinomatous, and suggests as the explanation for Young's figures the fact that the severer types of all diseases tend to gravitate to specialists of distinction.

This is a well-gotten-up book. The author's style is scientific, but enlivened with variations from conventional expressions common to most writers. The author's English may be described as elegant.

There is something personal about this book that touches the sentiment of the discerning reader. The author acknowledges his indebtedness to those who helped him. Among them are his wife, "who through many years kept together the data that have gone to make up the book." He mentions his friends who placed at his disposal their collections of material, photographs, and their laboratories. Of one he says, "So unstinted was his generosity that his material has become inseparably a part of my own." Of another he says, that "he, likewise, made me a welcome visitor in his laboratory, where I secured much information and many specimens." "Many others, the mere mention of whose names would be equivalent to presenting a roster of my professional friends, were equally kind." Of the two men who made the drawings for illustrations, he says, "The reader himself will be able to estimate my great obligation to them." This is no empty compliment, because the reader does find a book full of superb illustrations,—made from good, honest drawings,—some by John Bigger and some signed by Tom Jones—artists both, without frills or flourishes.

Perhaps it is not pertinent to the review of a book to get at the personal equation of the author, but when the delicate touch of sentiment reveals itself wisdom prompts its recognition.

J. P. WARBASSE.

LATERAL CURVATURE OF THE SPINE AND ROUND SHOULDERS.

By RICHARD W. LOVETT, M.D., Assistant Professor of Orthopaedic Surgery, Harvard Medical School. Second Edition, 192 pages, 184 illustrations. Philadelphia: P. Blakiston's Son & Co., 1912.

This second edition follows the same plan as the first—

anatomy and movements of the spine, mechanism, description and examination of scoliosis, pathology, etiology, occurrence, diagnosis, prognosis and treatment—except that a separate chapter is here given to the important subject of the relation of scoliosis to school life. The author's painstaking study of the mechanism of lateral curvature is rewritten and simplified. He departs from classical descriptive anatomy by dividing the normal movements of the spine into (1) flexion, (2) extension, and (3) side-bending—rotation. He continues the natural division of treatment into that for simple functional lateral curvature and that for structural scoliosis. Not until now has appeared so careful an analysis and so full a list of the various types of exercise given for simple lateral curvature of the spine. The brilliant results of Abbott, of Portland, Me., merely mentioned in this book, would seem to give a better prognosis for structural scoliosis, and the profession will therefore pause before placing its verdict on Lovett's conclusions as to treatment of the structural form; although this edition notes many details of marked improvement in the technic of methods until now used. If this edition had been held back a few months longer, Abbott's method could have been digested by the author and given its proper place in the book.

In discussing round shoulders, the author gives the results of the elaborate study of normal and faulty attitudes recently undertaken by Reynolds and himself, but does not draw very convincing conclusions therefrom.

Noteworthy as is the work of European investigators in scoliosis, the reader feels that space has been given them to the detriment of American contributors. Broadly viewed, the edition strengthens the author's authoritative position in the country on the subject he deals with. WALTER TRUSLOW.

TUMORS OF THE JAWS. By CHARLES LOCKE SCUDDER, M.D., Surgeon to the Massachusetts General Hospital. 391 pages, 353 illustrations, 6 in colors. Philadelphia and London: W. B. Saunders Company, 1912.

The delectable kernel of Dr. Scudder's book is the thirty odd pages on "The Diagnosis and Operative Treatment of Malignant Disease of the Upper and Lower Jaws." There is found what his colleagues wish to know: his opinions, his methods, his technic. This section is a delight and gives one the im-

pression that one has found a surgeon indeed—a man who has the knowledge, the surroundings, the conscience, the perspicacity, and the courage withal to be one's personal surgeon in time of need. It suggests a cause of the author's success in his profession and a reason for the high titles with which his name has been honored.

The chapter on odontomata is a good one. It deals with the pathological as well as the clinical aspect of its subject. Much of the book is perhaps too clinical and hence not entirely satisfying to those who open its covers to find light on moot points in twentieth-century surgery. The discussion of odontomata is not subject to this criticism.

The earlier part of the book is somewhat disappointing. It is largely made up of case reports of only moderate worth; some of them curiously enough interpolated in places where they are out of relation with the context. Statistics of foreign and domestic origin are quoted and compared, when their value must be slight. The necessity of exact classification and nomenclature, of patients' similar physical condition, and of operators' standard skill and after-care make deductions from ordinary groups of operative statistics valueless. This is especially true when many of the groups contain a limited number of cases.

The chapter on carcinoma of the jaws is instructive and interesting; that on sarcoma is extensive, but not altogether clear enough to convince the reader that the author has reached definite conclusions. In discussing partial, total, and inefficient operative attacks on sarcomatous tumors, the author says, "A partial operation may be most radical," and, "The objects of a partial operation are the complete removal of the disease, with less mutilation and better functional results than by any other method." In a preceding paragraph he has mentioned the conditions which permit the surgeon "to entertain the idea of a partial operation for malignant disease," and therein makes an antithesis between a "partial operation" and "a more radical and complete operation." It is feared that the exact meaning of these connected sentences may not be understood.

Of doubtful usefulness is the retention of the word *epulis*, called at first "a topographic term" and "applied to a new growth apparently (*sic*) seated upon the gum or upper edge of the alveolar border of the jaw." A chapter is devoted to its consideration, and then in the summary it is defined as "a con-

nective-tissue tumor midway in malignancy between a fibroma and a giant-cell sarcoma."

Part of the volume induces one to think of it having been written too hastily. Perhaps portions were prepared by an assistant to complete the monograph, because the author's real interest in other sections prevented him giving time to supervise and revise the result of an assistant's labor.

The chapters on tumors of the palate and leontiasis ossea are rather scrappy and partake of the nature of "fillers." That on prosthesis is suggestive of the Index Medicus rather than representative of the results of actual personal experience.

Many valuable statements are scattered through the pages of Dr. Scudder's monograph; but it must be confessed that they are somewhat buried under a mass of comparatively unimportant pictures, case histories, and statistics.

A big California orange is beautiful and often weighty, but just as much juice may be obtained from a smaller and less cumbersome fruit. Perhaps the second edition of "Tumors of the Jaw" will be subjected to judicious condensation and weigh the desired two instead of four pounds. JOHN B. ROBERTS.

THE SURGERY OF ORAL DISEASES AND MALFORMATIONS, THEIR DIAGNOSIS AND TREATMENT. By GEORGE V. I. BROWN, DD.S., M.D., Oral Surgeon to the St. Mary's and to the Children's Free Hospital, Milwaukee. Octavo, 740 pages. Lea & Febiger, Publishers, Philadelphia and New York, 1912.

In this volume the author presents the subject of oral diseases and malformations from the broad stand-point of general medicine, making the book a valuable reference for the surgeon, internist, or specialist working in associated fields. The subject matter is presented in a clear and concise manner, with very helpful illustrations. The first chapter deals especially with hemorrhage, shock, and methods of anæsthesia best suited for oral operations.

Pathological dentition and the general systemic disturbances that may arise therefrom have been well considered. The author emphasizes the importance of treating the removal of impacted and misplaced teeth as a strictly surgical procedure that should be carried out with all the precautions necessary in any other delicate surgical operation, instead of the strong-arm methods that are so frequently employed.

The importance of the oral manifestations of tuberculosis and

syphilis have been indicated in Chapter III and should be of especial interest to the dentist. The same may be said of the presentation of some of the more common skin diseases, such as urticaria, lichen planus, herpes, purpura, and others in Chapter IV.

Trigeminal neuralgia is thoroughly covered from the oral aspect. Diagnosis is fully discussed, the author reviewing the factors arising from within the mouth that are so often overlooked. The various methods of treatment have been considered, and only proven methods advocated.

Fracture of the jaws has been briefly taken up and the common methods of treatment all shown, though cases arise in practice that require different procedures.

The chapter on tumors should be of great interest to the dentist, as early diagnosis in the malignant cases is so important.

In taking up the diseases of the maxillary sinus, the author very properly considers that the large field of sinus work belongs to the rhinologist, though the majority of cases of dental origin are best understood by one with special knowledge and training in oral diseases. Through describing the nasal etiological factors he goes more into detail on the oral methods of diagnosis. The methods of treatment and indications for the various operations are explained.

In Chapter XI the author presents his method of rapid separation of the maxillæ for the relief of contracted nares, deviated nasal septa, and other nasal deformities. This work should be of especial interest to the rhinologist as well as the dentist and orthodontist. The reviewer has seen very satisfactory results following this method of treatment.

The last chapter deals with what the author considers his most important work—hare-lip and cleft palate. The various types of deformity and the methods and technic of operation necessary for their correction are fully illustrated and explained, the aim being to restore facial harmony as well as function. The condemnation of the Brophy operation seems unnecessary, when we consider the brilliant work of Brophy in this field.

HAROLD S. VAUGHAN.

A MANUAL OF SURGICAL TREATMENT. By Sir W. Watson Cheyne, Bart., C.B., D.Sc., LL.D., F.R.C.S., F.R.S., Hon. Surgeon in Ordinary to H. M. the King, Senior Surgeon to King's College Hospital; and F. F. Burghard, M.S. (Lond.),

F.R.C.S., Surgeon to King's College Hospital, and Senior Surgeon to The Children's Hospital, Paddington Green, London. New (2d) edition. Thoroughly revised and largely rewritten. In five volumes, Vols. I and II. Lea & Febiger, Publishers, Philadelphia and New York, 1912.

The first edition of this work was reviewed in the *ANNALS OF SURGERY*, Vol. XXXI, *et sequit.* At that time a favorable opinion was expressed of the work as a whole, though exception was taken to much of the contents of Vol. I, which could not be accepted as representing in the portion devoted to technic and asepsis the best standards of the day. The same criticism is again to be made in the present edition.

Vol. I, pp. 552, is divided into Inflammation and its Sequelæ, Wounds and Their Complications, Syphilis and Tuberculosis, Tumors, Deformities (contained in another volume of the original work). There are also chapters on the examination of the blood, the Wassermann reaction, vaccines, and opsonic index. Vol. II, pp. 570, describes the surgical affections of the soft tissues, of the bones, and amputations.

This second volume is admirably written, is up to date, and well supplied with illustrations, many of them new.

CHARLES L. GIBSON, M.D.

DUODENAL ULCER. By B. G. A. MOYNIHAN, M.S. (London), F. R. C. S., Leeds, England, second edition, 8 vols., 486 pages. Philadelphia and London: W. B. Saunders Company, 1912.

In the first edition of this work, which appeared in 1910, the author based his remarks on the observation of 187 operated cases. In the present enlarged second edition the author is able to refer to the experience gained in operating upon cases which presented unquestionable evidence of duodenal ulceration at the operating table.

Certainly among the many and great developments of modern abdominal surgery, no observations have been so interesting and in no instance the results of operative intervention so uniformly satisfactory as those recorded relevant to chronic ulceration of the duodenum.

The author shows us that in this condition we have a relatively common disease, which, until the surgeon began to explore the upper abdomen in cases of chronic indigestion, was

considered a rare finding—a disease which was thought, not longer than ten years ago, to be practically beyond the clinicians' ability to diagnose, while at present, owing chiefly to the concise, clear and definite description given by Mr. Moynihan, we have come to appreciate "that the diagnosis of duodenal ulcer is made with a degree of accuracy that is not exceeded in the case of any other abdominal disorder." What is probably the most remarkable feature in the history of this condition is the fact that the main points in the symptomatology are found to be recited with parrot-like regularity through generations of textbooks, and in every instance have been ascribed without reserve to the existence of a purely functional disturbance.

On studying the detailed histories of the author's cases, one readily recognizes many instances of personally observed patients who only a few years back were discharged cheerfully labelled with a diagnosis of hyperchlorhydria, nervous dyspepsia, biliousness, recurrent indigestion or some other befogging and meaningless term.

There are three notable additions to the text of the first edition. The question of jejunal and gastro-jejunal ulceration is accorded eighteen pages, over one hundred cases being considered and the operative technique for its relief described. The differential diagnoses between gastric ulcer, gall stones, appendicular gastralgia and duodenal ulcer are particularly interesting and instructive, and should be read most painstakingly by every physician.

The X-ray has been lately invoked to aid in the diagnosis, and Mr. Moynihan attributes much value to the evidence thus demonstrated of greatly increased activity of the stomach. The fact that the "pyloric cap" is in many cases deformed is not mentioned. The observations of A. C. Jordan, inspired by Arbuthnot Lane, which tend to show that many patients complaining of symptoms indicative of duodenal ulcer are due to a kinking at the duodeno-jejunal angle, are minimized by the author. Certainly his remarks that "the pain is due to distention of the duodenum resulting from obstruction" is directly opposed to all clinical experience and as Mr. Moynihan states "is devoid of any slightest support that I have ever been able to obtain."

The author's views regarding the etiology of gastric and duodenal ulcer are quite pertinent and indicate further the remarkable ability so frequently shown by him in making use of

the opportunities for observation. "There can, I think, no longer be any question that both gastric and duodenal ulcers are secondary to some toxic or infective process; the various stages of the disorder being infection, congestion of gastric mucosa, with erosion (possibly the result in many cases of retrograde venous embolism, as shown by Wilkie), superficial ulceration (medical ulcer), and finally chronic ulcer. In many of my cases the primary septic focus would certainly appear to have been in the appendix."

In its entirety this monograph is not only the most satisfactory résumé of our present knowledge on this most interesting subject, but suggests many problems as yet unsolved which may serve to stimulate further research in it. JAMES T. PILCHER.

CYCLOPEDIA OF AMERICAN MEDICAL BIOGRAPHY. By HOWARD A. KELLY, M.D., Professor of Gynecologic Surgery at Johns Hopkins University, Baltimore. Two octavo volumes averaging 525 pages each, with portraits. Philadelphia and London: W. B. Saunders Company, 1912.

Dr. Kelly has placed the medical profession under very great obligations in undertaking the compilation and publication of these biographies of the eminent physicians of this country who have graced the annals of the past. It covers the period from 1610 to 1910, a period of three hundred years. In a very notable degree it supplements the volumes of Thacher, which were published in 1828. The charming style of Thacher, however, and the fulness of his biographies are peculiar to that earlier book, owing to the fact that by Thacher himself the various biographies were compiled.

Dr. Kelly with his characteristic contagious enthusiasm has succeeded in enlisting as helpers in his work a long list of contributors representing every part of the country,—each State was assigned to some particular individual under whose supervision the gathering of the material from that part of the country was carried on. In his Preface the author gives full credit to the various sources from which the material that has gone into these volumes has been drawn.

The biographies themselves are preceded by an excellent series of historical essays in which the development of medicine and surgery in America is outlined.

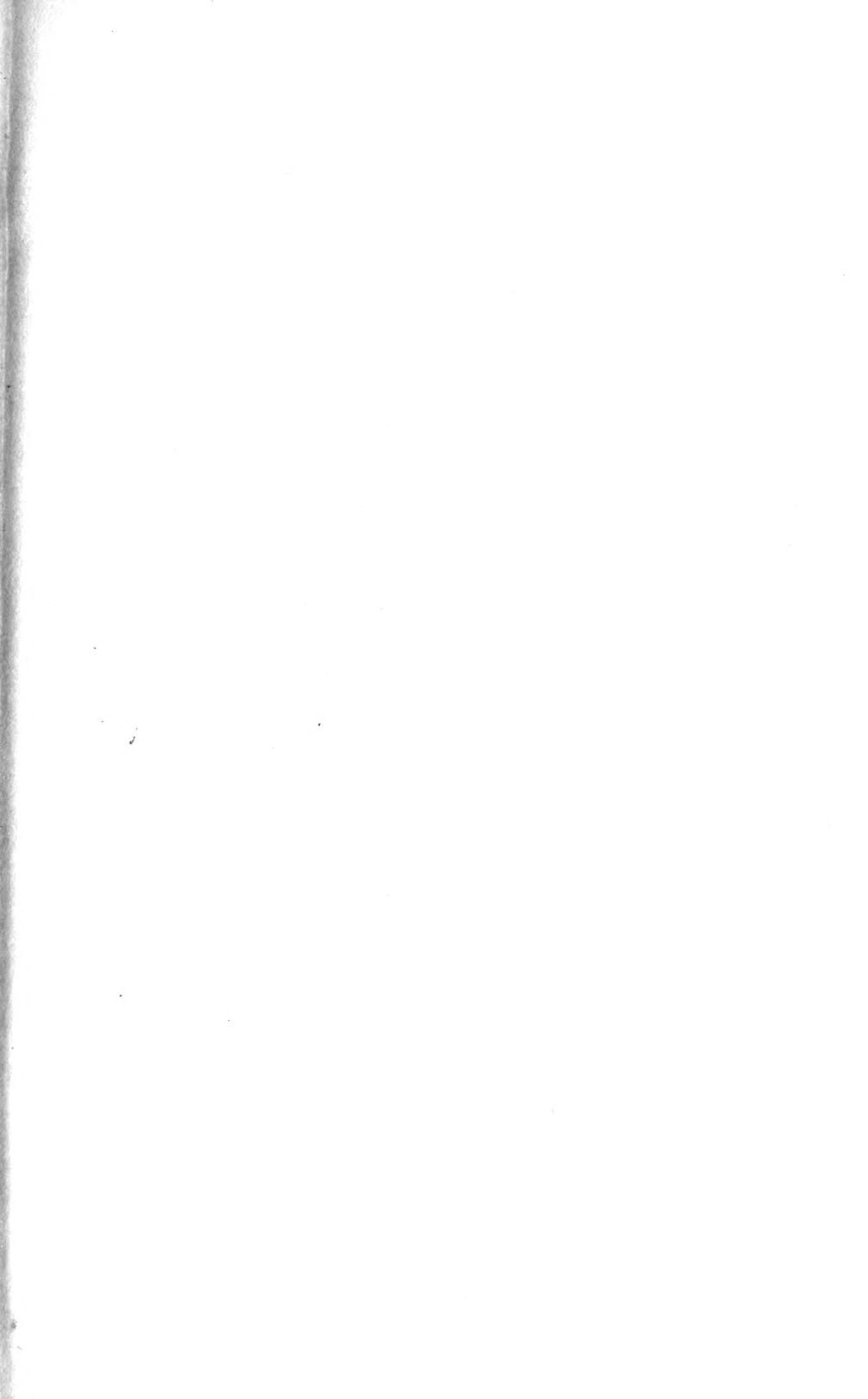
In preserving the professional spirit, it is impossible to attach

too high a place to the biographical records of those who have presented it in a most eminent manner in the past, for it is chiefly as the professional spirit is incarnated in a living man that it impresses those by whom he is surrounded and is passed on from one generation to another. The study of the characters, lives and works of those who have embodied in an eminent degree professional virtue in the past is a most potent inspiration to the men of the present and a most valuable safeguard against the assaults of the crass materialism and commercialism with which our modern life is so strongly tinctured.

Dr. Kelly quotes as a motto, prefixed to his Preface, these sentences from Sir Benjamin Ward Richardson:

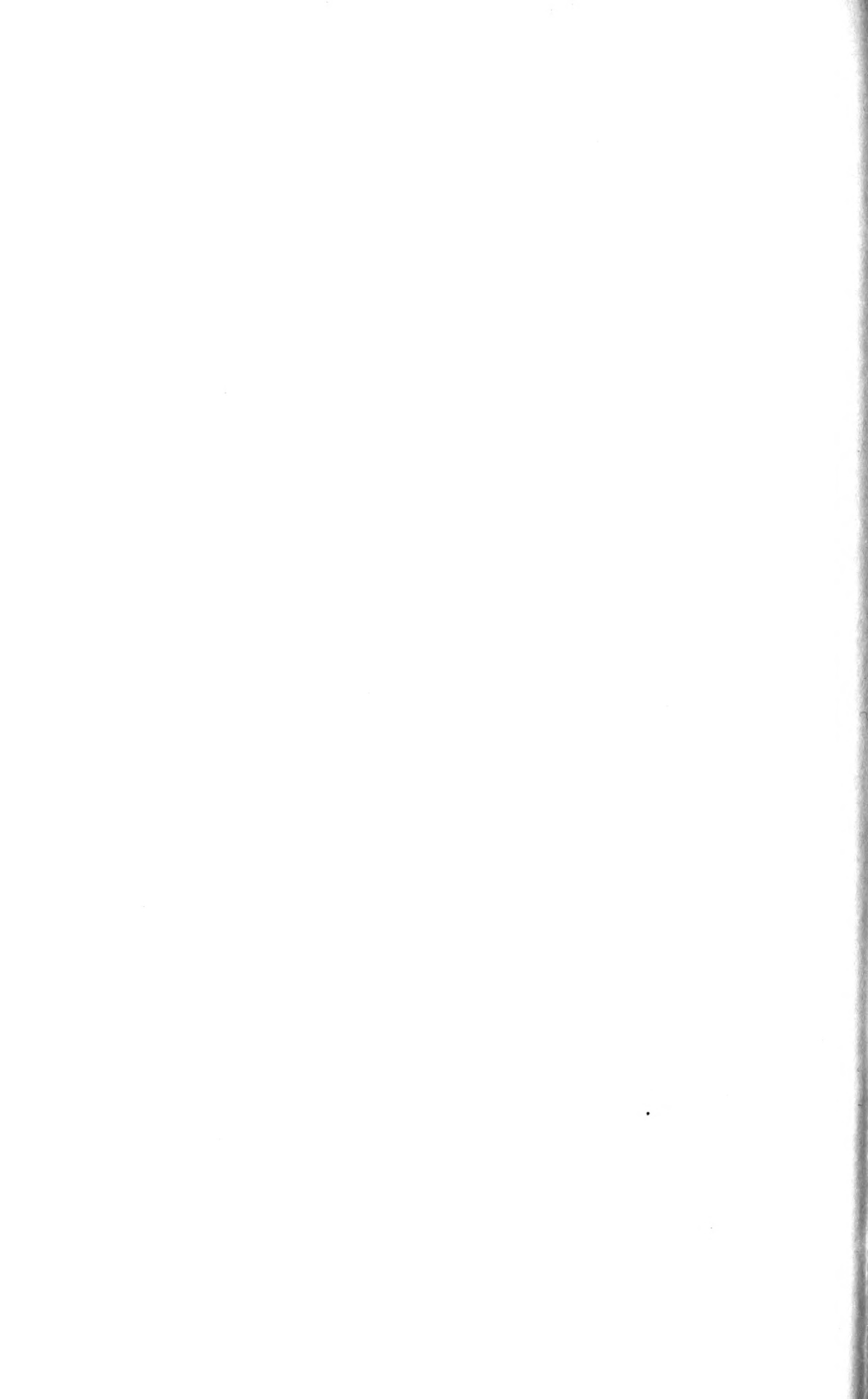
“From the experience thus obtained, from the happiness that has arisen from it, and from the use I know it has been to many others, I would urge every student, whether medical or general, to start life with a good biographical training. Sometimes it seems to me as if the whole field of knowledge were open to a man that at first became conversant with the lives, works and characters of his predecessors who have cultivated the world and its literature.”

To such sentiment the reviewer wishes to add his most unqualified adherence, and to express his own gratitude to Dr. Kelly for the great work which he has done in obtaining for American medicine the present volumes. Very properly they are dedicated to Sir William Osler, whose work in medical history has done so much to promote interest in that direction among the physicians of America.









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